HEATING & VENTILATING

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

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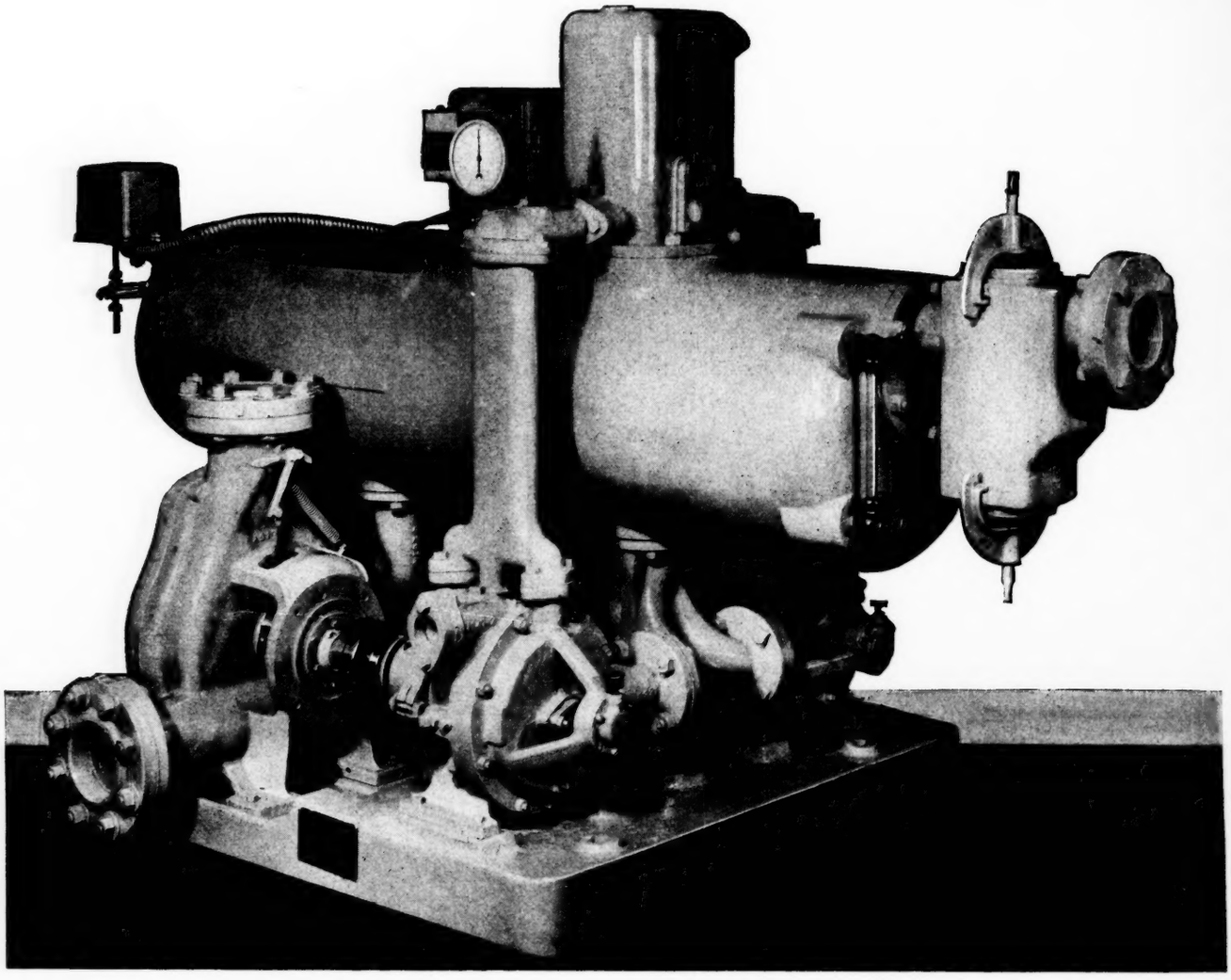

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Fan to Motor Connections—What the Heating Engineer Should Know about Them

By GEORGE H. HALL

HAVING laid out the ventilating and exhaust system of a building, selected fans and blowers of proper capacity, and determined the horsepower and speed of the motors by which they are to be driven, the heating and ventilating engineer faces the problem of connecting the motors to the fans and blowers in the most efficient, economical and practical way possible.

Since this problem is one of a mechanical rather than of a ventilating or electrical nature, its importance is frequently overlooked by both the ventilating and the electrical engineer. It deserves, however, the same care and attention as is demanded by the other features of the equipment, since a faulty or inefficient connection may cause troubles that will reflect adversely on the entire ventilating system.

For connecting the motor to the fan or blower which it is to drive, two methods are available and each should receive a careful analysis, on the basis of factors such as motor speed, cost, maintenance and space limitations, which will result in the selection of the method best suited to any individual case.

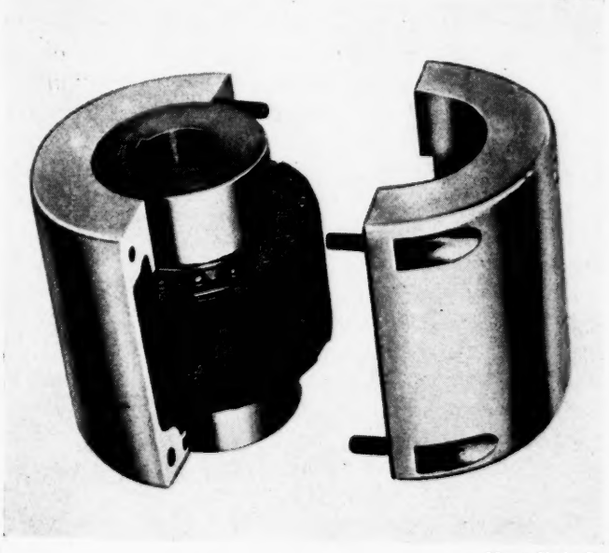
These methods are: (a) by direct connection, and (b) by connection through some form of transmission.

Direct Connection

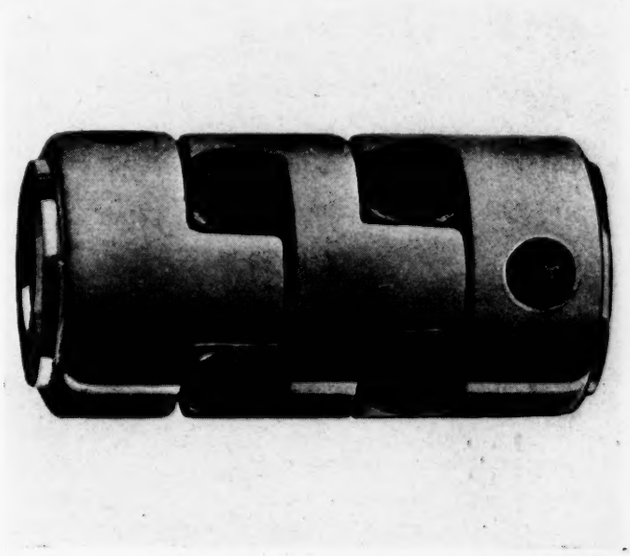
For this type of connection the speed of the motor and that of the fan correspond. The most natural procedure would be to mount the fan blades directly upon the motor shaft, thus dispensing with the need of any form of coupling. The practical objection to this method is that it usually requires motors having shafts longer than those of the standard construction. This puts the motors in the special class and not only increases their cost but involves the loss of the interchangeability feature which is of so much value when a change or replacement of the motor is necessary. This method of fan mounting is therefore most frequently employed in the case of small fans or blowers which are built in quantity, so that the first cost of the motor is reasonably reduced and replacement can be provided for by an adequate stock of spares.

The most generally used method of direct connection is by the use of some form of coupling, in the selection of which a number of factors deserve careful consideration. For practical purposes any particular make of coupling that may be selected should be of the flexible type. While motor and fan shaft should naturally be closely aligned, any attempt to secure perfect alignment would involve unnecessary expense and there could be no assurance that such alignment would not be impaired, either in the process of erection or in the course of operation. Foundations may settle, bearings may wear, other adverse circumstances may occur, so that the most perfectly aligned installation will in time become sufficiently out of line to cause serious trouble if an inflexible, solid coupling is employed. Flexible couplings will automatically compensate for any lack of true alignment within reasonable limits and, if they are not considered as an excuse for unsatisfactory workmanship but simply as a remedy for conditions that may arise even with most careful installation, their use will prove satisfactory.

Flexible couplings consist of two halves one of which is rigidly mounted on the fan shaft and the other on the

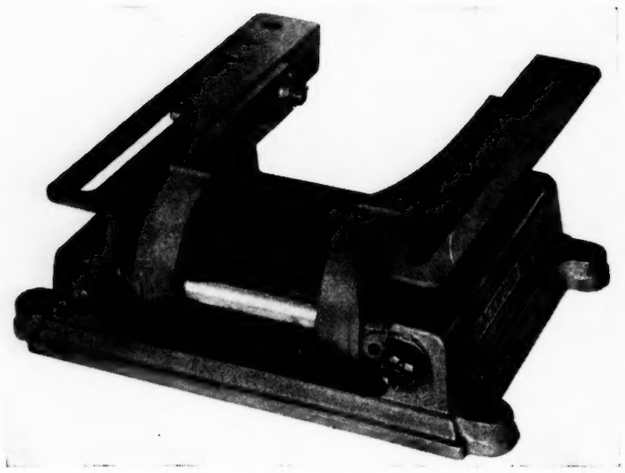


Morse Chain Co.

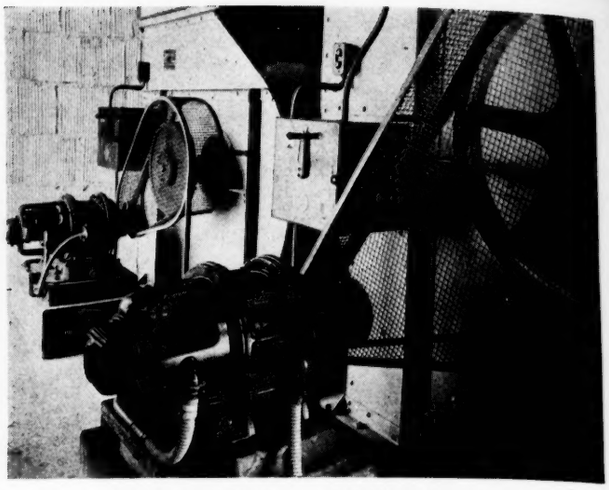


Loveioy Tool Works

Typical forms of resilient flexible couplings suitable for fan service



Tension control motor base



Safety guards for ventilating fan drives

motor shaft with a space between them of a width depending upon the size of the coupling. These halves are then connected together by some form of flexible transmission which allows a degree of flexibility but at the same time provides a positive drive. Based on the character of the flexible member these couplings may be classified as resilient and non-resilient.

In the resilient type, the half-couplings may take the form of clutch jaws between the projections of which some resilient material such as rubber or leather is inserted, or the two halves may be connected by laminated steel pins the flexibility of which allows smooth transmission when the two halves are out of line.

In the non-resilient type the halves are in the form of gear sprockets over which a flexible chain is wrapped or, in place of the chain, a sleeve having internal gearing is employed so that the halves may slide or change their relative positions but still maintain constant driving contact.

While either type will satisfactorily transmit the power under adverse alignment conditions, the resilient type is more suited for use in connection with fans and blowers in ventilating installations such as residences, office buildings, and schools where quietness of operation is essential. For factory, or other industrial purposes, the type should be selected on the basis of other considerations which may make one or the other more desirable for the particular purpose.

Connection through Some Form of Transmission

Before deciding upon the use of some form of transmission connection the matter of relative cost of slow speed motor with coupling for direct connection should be balanced against that of the high speed motor with transmission. So many factors enter into such an analysis that no positive rules can be laid down that will apply in all cases. Each case must be considered as an individual problem but one general suggestion may be of assistance as indicating the probable result. Fan and blower speeds are generally below 1200 r.p.m., while the most commonly used motors run at speeds of 1200 and 1800 r.p.m. Although motors may be built for much slower speeds the cost will be found to rise rapidly as the speed decreases. Motors running at speeds of 900 or 600 r.p.m., while more expensive than those of the higher speeds, are not in the prohibitive class and may often be employed at a saving over the cost of the higher speed motor with transmission. Below 600 r.p.m., however, the increased motor cost usually swings the balance in favor of the use of speed reducing transmissions.

Other factors, such as available space, quiet operation, and speed control should also receive careful attention in arriving at the final decision.

The most generally used form of transmission for ventilating service is the belt drive, which may employ the conventional flat belt or some modification in the shape of a V or round belt with grooved pulleys.

So many factors enter into the ventilating problem that even with the most careful calculations it is frequently found desirable to change the fan speed, to obtain an increased or decreased volume, after the installation is completed. To accomplish this with the flat belt drive involves simply a change in either the fan or motor pulley. Belt drive also provides good insulation against transmission of motor hum or vibration but care should be given to the tension of the belts which often, due to being too loose, set up an undesirable amount of noise on account of flapping and this may be transmitted into the ventilating system. The slide base provided for the adjustment of belt tension should be of the sound insulating type, for even with motors built for quiet operation, there may be inherent vibrations, too slight to be noticed in the vicinity of the motor, but which, when transmitted through floors or walls, may become amplified and thus produce objectionable noise at points far removed from the fan room.

For flat belt drives, cemented or endless belts should be used as the ordinary laced connection or the metallic fastener will produce a jarring effect on the fan shaft which is likely to cause audible noise in the system. Use of wood, composition, or paper pulleys is also often recommended because of their gripping properties which prevent belt slipping and thus allow operation at low belt tension.

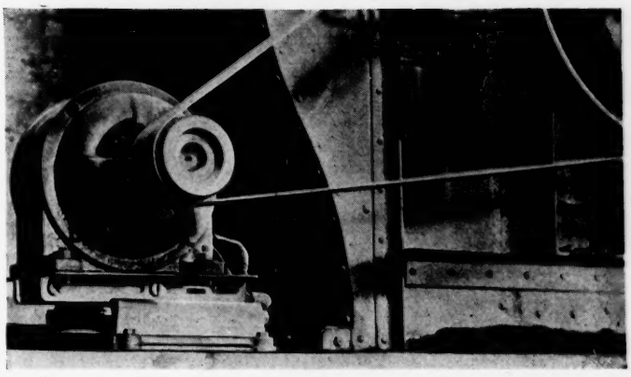
Belts of the V type are much used, especially where center distances have to be short. Due to the grip of this type of belt in the grooves of the sheaves the

actual contact of the belt with the pulleys is great enough so that the center distances between shafts may be reduced to short limits. This feature also permits of a higher ratio between the driving and driven pulleys than can be obtained with ordinary flat belts unless the center distance be great or an independent belt tightening idler be used. With V-belts, on short center distances, the practical limit of pulley ratio is about seven to one. V-belts are also quiet in operation and do not transmit motor vibrations.

The standard motor slide base has provision for the regulation of belt tension by the manual adjustment of the belt tightening screws but, as the belt stretches with use, the tension is lessened and slipping takes place, involving loss of driving power. This continues and increases until the tension is again adjusted. If, to prolong the periods between adjustments, the belt is given an initial tension too great, undue wear on the bearings and strain on the belt itself is involved.

As a remedy for these tension troubles, the tension control motor base has been developed by means of which the tension is maintained in proportion to the actual load which the motor is carrying. With the tension base the motor is supported on a pair of arms, corresponding to the usual slide rails, and these arms are pivoted at their inner ends so that tension on the belt is effected by the weight of the motor and by the pull on the belt. This results in a belt tension, comparatively light when the motor is running under partial loads, which increases as the load becomes greater and thus provides adequate tension for heavy starting torque and overloads but maintains normal tension when the motor is carrying its rated load. This cradling of the motor also takes care of the usual lengthening of the belt from prolonged operation so that shortening or adjustment is needed only when the belt has attained an abnormal stretch.

Many installations require that the fan output, and consequently its speed, shall be adjustable for varying conditions of operation and this is generally accomplished by the use of an adjustable speed motor. Such motors are necessarily more expensive than those built for operation at a single constant speed and in some cases it will be found that a constant speed motor with a mechanical speed changing device can be used to advantage as connecting link between motor and fan.



Motor with tension control base driving ventilating fan

In the use of any form of connection between the motor and the fan the matter of safety should not be overlooked. Most of the standard forms of couplings are now built with this factor in mind. All connection bolts and hub screws are recessed flush with the surface so that there are no projections or, better still, the entire coupling is covered over with a casing so that accidental catching of the hands or clothing in a running coupling is impossible. Where such safety provisions are not incorporated in the coupling itself a guard of metal or screening should be erected around the coupling to insure safety in operation.

The belt drive also should be guarded against accidental contact and this can usually be easily accomplished by the use of metal screening or grille carried on a light framework. The photograph of safety guards on the preceding page illustrates a form of drive protection which will serve as an excellent suggestion for the design of such protective devices.

Air Conditioning in the Paper Industry

OF all products which respond to changes of humidity in the surrounding atmosphere, paper is one of the most sensitive. Cellulose, which comprises the major part of most sheets of paper, will retain small amounts of moisture in a very stubborn manner and readily absorbs more from a moist atmosphere.

In considering air conditioning problems in the paper industry, relative humidity is more important than temperature, and different conditions are required in different stages of the process. For example, where the sheet is forming on the fourdrinier part of the machine, the paper itself is already so wet that the humidity of the surrounding air matters not at all. On the other hand, were hot air from the dryers, heavily moisture-laden, to pass freely above the wet end of the paper machine, water would drip from pipes and roof trusses and probably fall on the forming sheet and cause blemishes or breaks. No effort is made in the press part of the paper machine to subject either the sheet or the felt which carries it, to controlled air conditions, other than to ensure that winter air is warmed to room temperature before entering into the room.

On entering the dryer part of the paper machine, conditioned air becomes of immediate importance. From 2½ to 3 lb. of water enter with every pound of paper, from the final press. All of this moisture excepting one ounce must be evaporated in the dryers. To accomplish this the sheet is pressed against the surface of the revolving drum dryers by an endless fabric belt or dryer felt, through which most of the moisture must find its way into the air. Between successive dryer rolls the sheet of paper and the dryer felts are separated and exposed to the air circulating in the dryer section, considerable evaporation taking place, thus preventing the dryer felts from becoming saturated. Moisture laden air from the dryers must be removed, and this is done by suitable ducts and exhaust fans.—*Refrigeration and Air Conditioning (Canada).*

Heating a Small Prison

IDEAS concerning methods of housing criminals have changed considerably in the past 50 years. This is strikingly illustrated in the case of the new Wayne County Prison which was recently erected in Honesdale, Pa. The old prison was a solid masonry structure with very narrow windows which admitted only a small amount of light.

In direct contrast is the new building which has been erected next to the old one. Windows of detention-type steel sash are provided on all sides and two large skylights are placed in the roof. All window openings are barred with toolproof steel bars. There are 25 individual cells, 24 of which are for male prisoners. These are on both sides of a large corridor and on two levels. The other cell is for a women's prison and is on the second floor over the sheriff's office. Approximately half of the second floor is taken up by the women's section. It contains, besides the cell mentioned previously, a dormitory, a recreation room, and combined toilet and wash room.

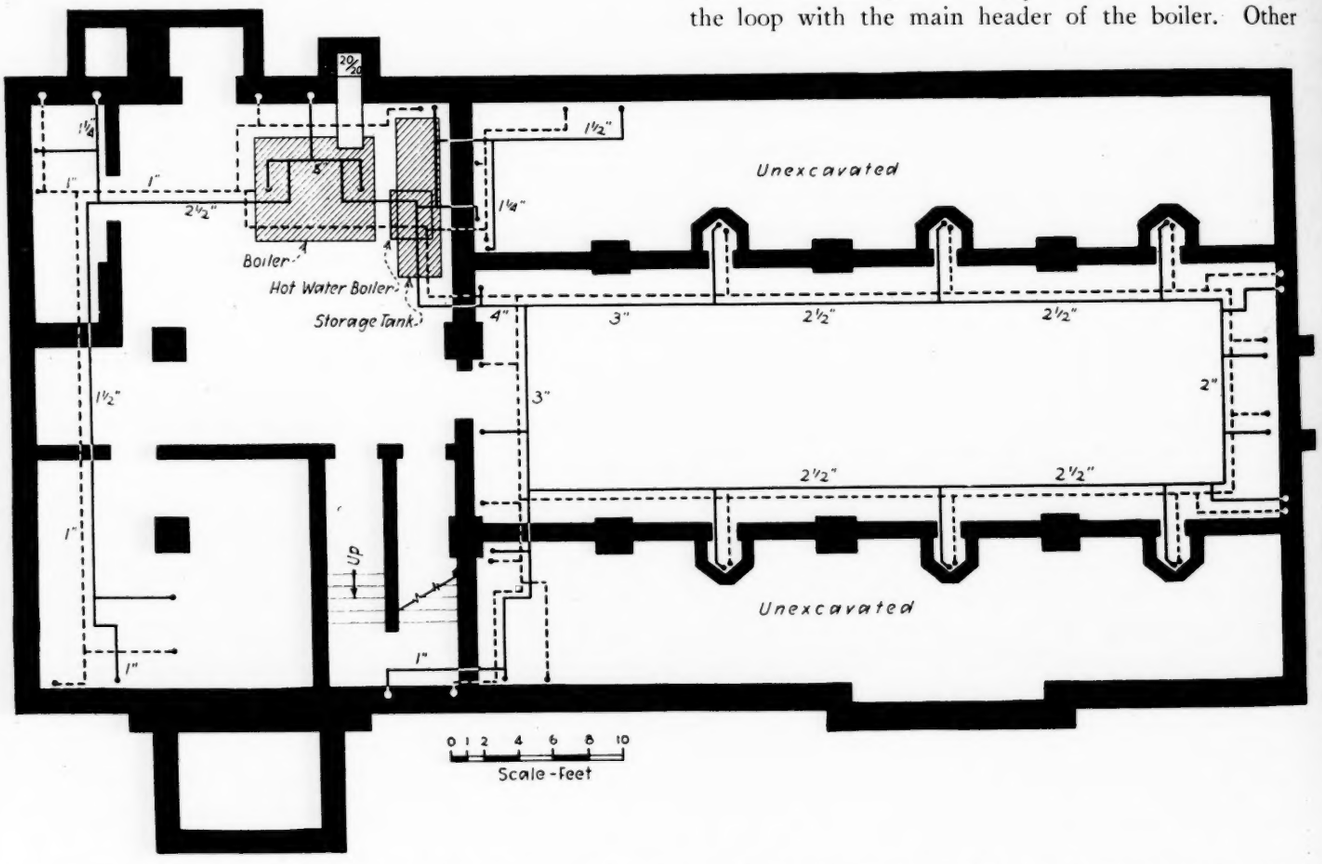
On the first floor, beneath the women's quarters are located the lobby, a food service room, sheriff's office, and a dispensary. Ten of the men's cells and a large shower room are also located on the first floor. The other 14 cells are on the second level. Each of the cells contains a large window, a direct, wall-hung radiator, a wash basin and toilet. As stated before, all the cells in the men's section are on both sides of a large corridor which extends from the first floor to the roof. The two large skylights in the room furnish exceptionally good lighting for this space.

The exterior walls of the building are constructed of cinder blocks placed on a poured concrete foundation The space between outer and inner blocks is filled with concrete, reinforced with ¼-in. rods, 6 in. each way. The floors are of poured concrete and the roof is of gypsum tile with slate above. Only a portion of the basement is excavated. It contains the boiler and related equipment, coal storage, and access room to all the piping wells.

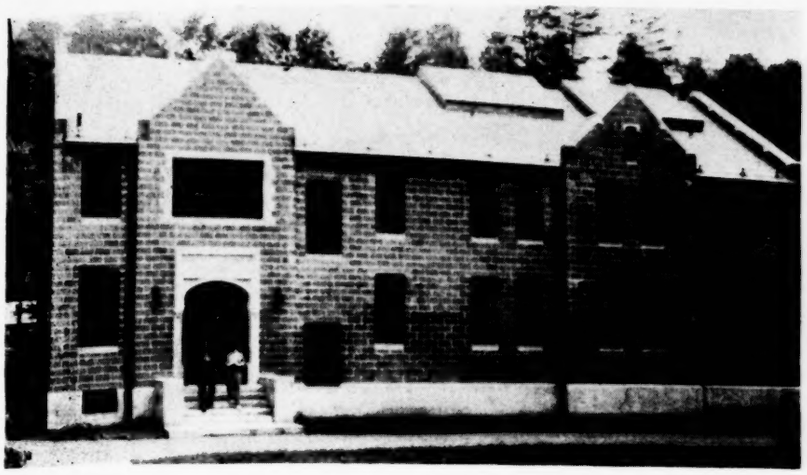
Heating a prison offers many problems not encountered in other types of structures. This is true because not only the structural features, but also the conditions to be maintained are different. The large number of very small rooms, together with the large volume spaces encountered in buildings of this type, makes the problem an unusual one.

A two pipe, low pressure steam system has been installed for heating. Direct radiators, all wall hung, are employed throughout the building. All except the corner cells have 21 sq. ft. radiators. The corner ones have 38½ sq. ft. of surface. Eight radiators are employed for heating the corridor in the men's section.

The steam piping for supplying the radiators in this section is in the form of a loop. A 4-in. main connects the loop with the main header of the boiler. Other

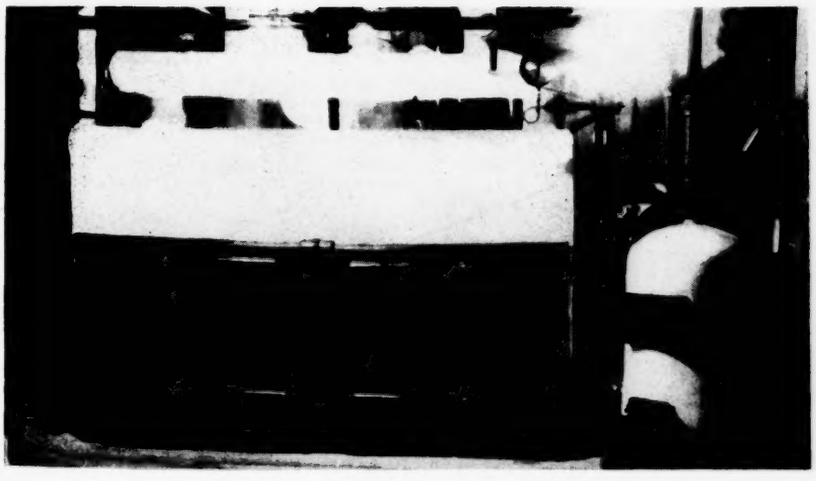


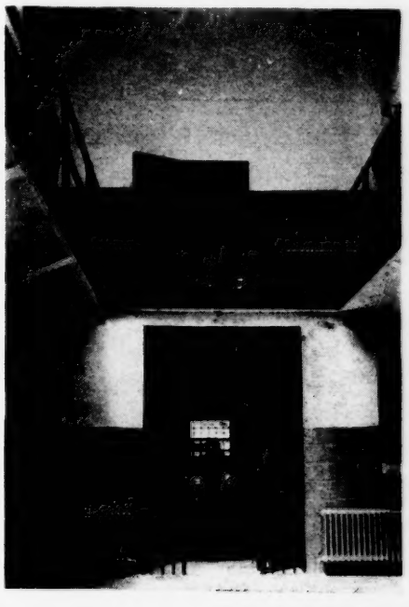
Basement of Wayne County Prison showing arrangement of piping for heating system. Solid lines indicate steam mains; broken lines show returns.



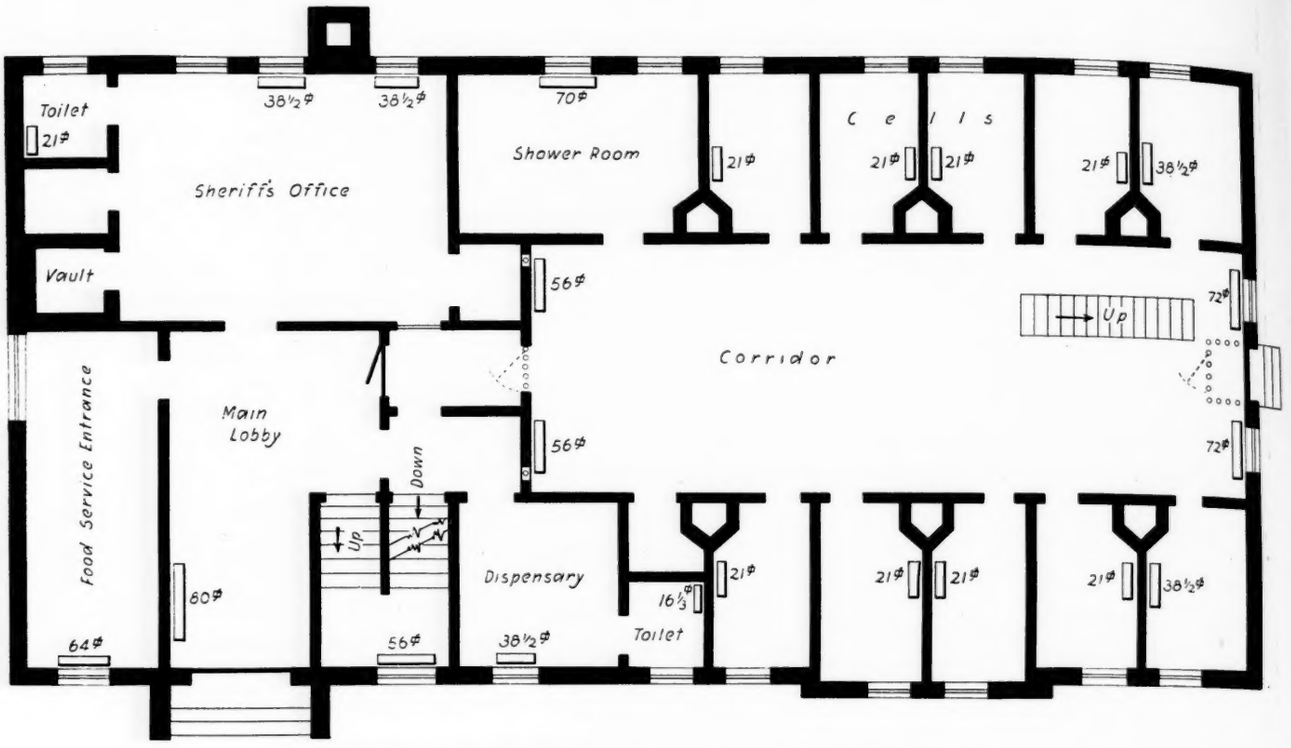
(Above) Front elevation of the new Wayne County Court House, Honesdale, Pa. The exterior walls are of cinder block on a poured concrete foundation. (Right) A view from the corridor looking into one of the cells. The plumbing and heating fixtures are in the corner as shown, conveniently located to pipe wells which carry heating and plumbing lines.

(Left) View of the corridor from the lobby. The stairs lead to a balcony which serves the second floor. (Above) The old prison which adjoins the new structure. The old building was of solid masonry with very narrow windows.





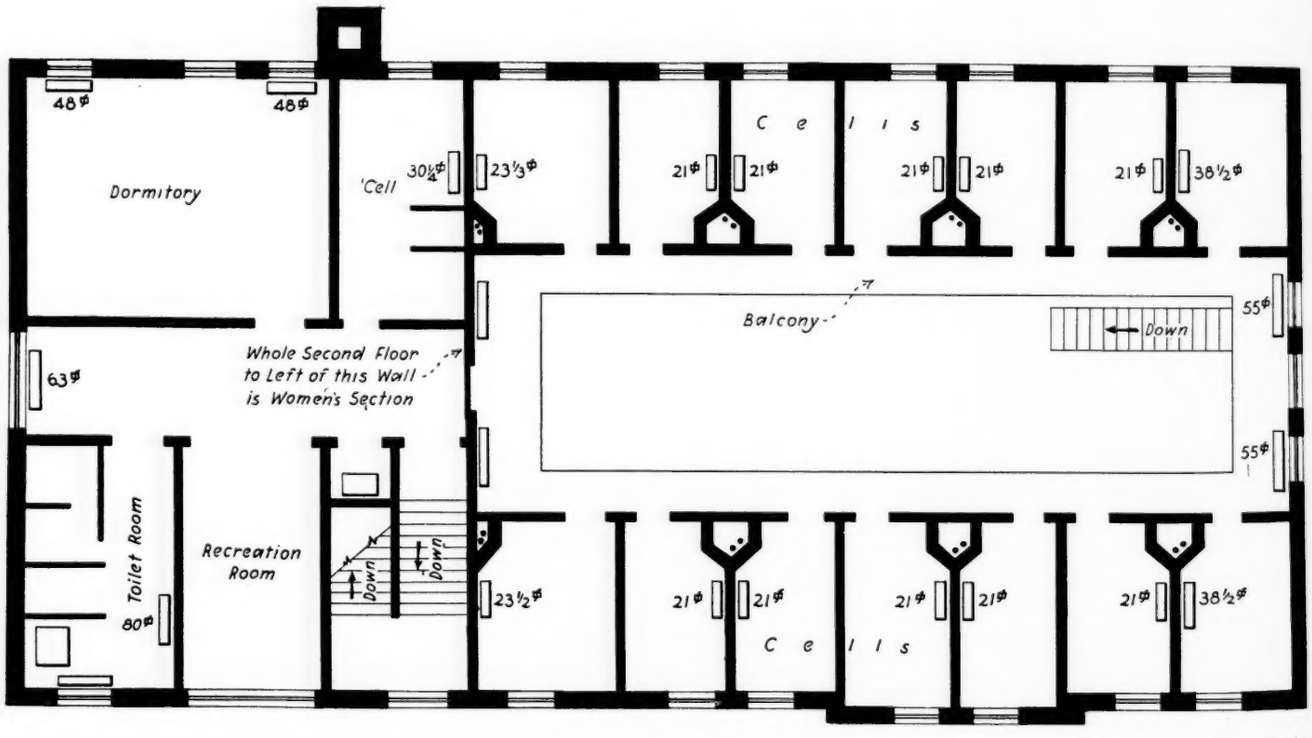
(Above) Sectional cast iron boiler which heats the new prison with the small hot water heater shown at the right. The boiler is hand-fired. (Right) View in the corridor looking toward the main lobby of the prison. The doorway above leads to the women's section.



First floor showing arrangement and amount of radiator surface

supply mains are tapped from this main header for the radiators in the other sections of the building. The risers which carry steam to the radiators in the men's section run up from the supply loop in the basement to the various radiators through pipe wells. The pipe wells are located between the cells and carry the steam risers and returns as well as the water supply and waste pipes. A steel door in front of these wells at each floor level makes it possible to repair any of the pipes without tearing down a section of the wall. There are six pipe wells in all. All valves, traps, etc., for controlling heating and plumbing systems are located in pipe wells, so that such equipment cannot be tampered with by unauthorized persons.

Each of the radiators has a modulation valve on the supply end and a trap on the return end. The con-



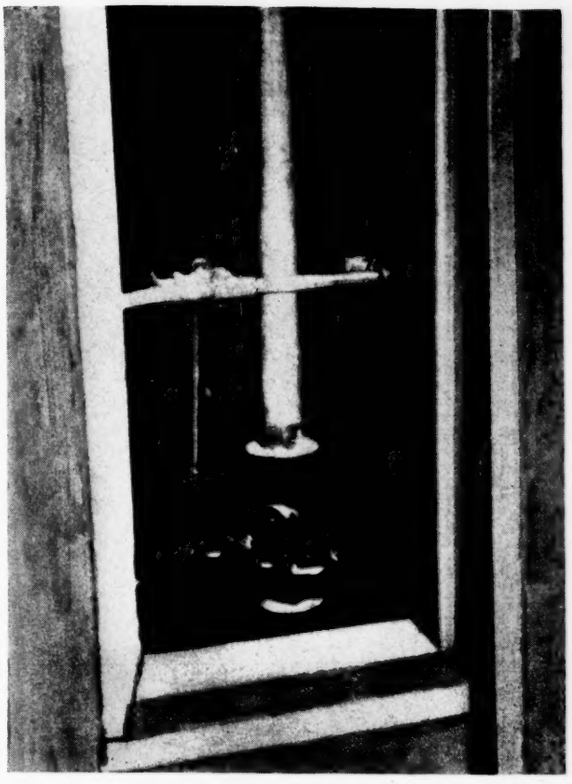
Second floor. Small enclosed spaces between cells are pipe wells which carry heating risers and returns and plumbing lines from the basement.

densate and air flow through a dry return back through a vent trap and boiler return trap to the boiler.

The boiler is made of cast iron and is of the low water line type. Normally, makeup water is fed into it by means of a hand valve. In cases of emergency, however, when the water line falls below a certain point, a boiler protector device injects water until the water level is brought back to the safety line.

When the system is operating under less than 1 lb. pressure the condensate flows by gravity back into the boiler through the air vent trap. The air vent valve discharges any air that returns with the condensate into the atmosphere.

When the steam pressure increases above 1 lb., a check valve in the return line closes to prevent the water line in the return line from rising. The condensate then flows into the boiler return trap. When the water level in the trap reaches a certain point, a float in the trap opens a valve in the pipe leading from the boiler. This allows the steam to enter the trap so as to equalize the pressure in the return trap and boiler. A check valve in the condensate return then closes and the water in the trap flows by gravity into the boiler. When the trap becomes nearly empty the valve admitting steam from the boiler is closed and the cycle is repeated.



View of pipe well taken through access door from corridor. Heating and plumbing piping lines are carried in these wells.

Hot water for the showers and wash basins is supplied during the summer by a small coal fired boiler which is placed next to the main heating boiler. In the winter, the water is heated by an indirect heating coil installed below the water line on the heating boiler. A 30 in. x 9 ft. horizontal tank is used for storing the water.

An excellent job has been done in insulating the heating system. The boiler and smoke pipe have been covered with a four-ply asbestocel finished with two coats of asbestos cement and troweled smooth and hard. All the supply lines and branches in the basement, the supply and return risers in the walls, and all the concealed supply and return laterals are covered with three-ply asbestocel. The fittings are insulated with plastic asbestos and covered with canvas.

The building was erected at a cost of $45,000 under the direction of the commissioners for Wayne County—C. B. Cobb, D. M. Eno, and C. A. Herrman. The architects were Lewis Hancock and Emerson C. Willson of Scranton, Pa.; the builder was W. F. Sutter, and the heating contractor Ernest Daniels.

Ultra-Violet Rays May Play Important Part in Hospital Air Conditioning

ULTRA-VIOLET air, completely free from contaminating bacteria, is described in the current issue of Science, official publication of the American Association for the Advancement of Science.

Tests conducted at Harvard University by Drs. William Firth Wells and Gordon Maskew Fair make it apparent, they report, "that ultra-violet light has a destructive power for bacteria of a higher order of magnitude in air than in liquids or other environments not highly transparent to ultra-violet radiations."

The Harvard scientists filled a room of about 2,000 cu. ft. capacity with colon bacteria by spraying with an atomizer. Samples of air were then withdrawn from the room and the number of bacilli determined in 10 cu. ft. of air. A 500-watt quartz mercury-vapor electric lamp served as the source of ultra-violet light.

When sprayed in a darkened room, 5,200 bacteria were found floating in the 10 cu. ft. air sample one minute after the spraying. But when the ultra-violet lamp was turned on not a single bacterium was found in a similar air sample.

Four sets of tests were made, and in each case the results were the same. Whenever the ultra-violet rays were turned on the bacteria were instantly destroyed.

The experiments promise to have an important bearing on the air conditioning of rooms in the near future, particularly in hospitals and in environments where bacteria are more likely to be most dangerous, such as in operating rooms of hospitals, and sanitariums for the tubercular and sufferers from other bacterial diseases. It may also prove highly useful in combating the spread of disease during epidemics.

In one of the tests the lamp was turned on in the midst of an experimental run. With the lamp off, there were 9,500 bacteria in the first minute after spraying, 2,500, 16 min. after and 890 after half an hour, and one after the lapse of 42 min. When the lamp was turned on not a one was found.

Estimating Air Conditioning Operating Costs

IN the 1935 report of the air conditioning committee of the Edison Electric Institute† are the first published data issued by the Institute on the operating costs of air conditioning systems. With the movement of more utilities into the field of promoting the use of summer air conditioning, there has arisen the need for a knowledge of the cost of operating such systems so that prospective users may obtain reliable and concise estimates of operating costs of prospective systems. It is the Intitute's belief that if the important facts about an installation are known, adjustments can be made to provide estimating data for contemplated installations, even though the climatic conditions under which the

†Air Conditioning, 1935-Publication No. C7, published by Edison Electric Institute, 420 Lexington Ave., New York: price 50 cents to members, $1.25 to non-members.

TABLE 1.—SUMMER AIR CONDITIONING OPERATING DATA FOR RESIDENCES

	New Orleans	St. Louis	St. Louis	St. Louis	St. Louis	Dallas	Washington	Miami
Conditioned Rooms	Single	Living Room	Dining and Two Bedrooms	Living Room	Bedroom	Living, Dining, and Two Bedrooms	Combined Living and Sleeping Room	Bedroom
Space conditioned, 1,000 cu. ft.	2.1	—	—	—	—	—	3,840	—
Duration of operation, hr. per year	2,180	868	1,355	592	835	1,800	June to January	1,095
Maximum demand, hp.	1½	1½	6	1½	1⅝	3[1]	2[2]	1¼
Energy consumption, kw-hr. per year	2,457	1,112	4,074	1,186	1,252	3,425	1,600	523

[1]Remote compressor serving four units. This figure does not include horsepower of fan motors on units.
[2]Remote compressor serving one unit. This figure does not include horsepower of fan motor on unit.

TABLE 2.—SUMMER AIR CONDITIONING OPERATING DATA FOR RESTAURANTS

	Washington[1]	St. Louis	Dallas	Houston[3]	Washington	Miami	New York
Space conditioned, 1,000 cu. ft.	60.8	16.7	—	3.2	35.1	17.5	37.8
Duration of operation, hr. per year	—	1,253	3,066	4,400	—	—	1,900[5]
Maximum demand, hp. per 1,000 cu. ft. of space	1.82	1.08	—	1.64	0.63	0.72	0.55
Water consumption, cu. ft. per cu. ft. of space per year	—	—	—	24.8	—	—	29.0[5]
Energy consumption, kw-hr. per cu. ft. per year	0.690[2]	0.572	—	4.02	0.298[4]	1.060	0.388

[1]Hotel dining room. [2]June to January only. [3]Lunch wagon. [4]May to January. [5]Estimated.

TABLE 3.—SUMMER AIR CONDITIONING OPERATING DATA FOR STORES

	New Orleans	New Orleans	St. Louis	St. Louis	Dallas[1]	Houston	Washington	Washington	Miami	Miami[4]	New York
Space conditioned, 1,000 cu. ft.	1,476.0	34.0	28.2	50.0	1,750.0	110.0	156.0	27.5	117.5	11.6	112.0
Duration of operation, hr. per year	1,370	900	1,536	1,200	1,450	1,350	[2]	[3]	2,100	1,100	1,600
Maximum demand, hp. per 1,000 cu. ft. of space	0.32	1.30	0.23	0.32	0.22	0.36	0.25	0.33	0.60	0.45	0.18
Energy consumption, kw-hr. per cu. ft. per year	0.327	0.712	0.262	0.216	0.283	0.265	0.147	0.216	0.774	0.126	0.166
Type of store	Large	Specialty shop	Specialty shop	Women's apparel	Large	Clothing	Department	Specialty	Retail	Specialty	Clothing

[1]All data estimated [2]May to January [3]July to January

TABLE 4.—SUMMER AIR CONDITIONING OPERATING DATA FOR LARGE OFFICES AND OFFICE BUILDINGS

	New Orleans	New Orleans	St. Louis	St. Louis	Chicago	Houston	Houston	Washington	Miami	New York
Space conditioned, 1,000 cu. ft.	39.6	—	105.5	1,578.0	—	60.0	1,900.0	2,244.0	40.8	—
Duration of operation, hr. per year	1,048	920	1,720	1,253	1,000	1,200	1,500	—	2,160	1,100
Maximum demand, hp. per 1,000 cu. ft. of space	0.252	—	0.426	0.177	—	0.200	0.362	0.191	0.416	—
Water consumption, cu. ft. per cu. ft. of conditioned space per year	1.82	—	5.68	1.62	—	2.62	2.65	—	—	—
Energy consumption, kw-hr. per cu. ft. conditioned space per year	0.0994	—	0.706	0.172	—	0.247	0.401	0.060	0.614	—

TABLE 5.—SUMMER AIR CONDITIONING OPERATING DATA FOR BANKS

	Chicago†	Houston	Oklahoma City	New York
Space conditioned, 1,000 cu. ft.	1,292.0	298.4	200.0	—
Duration of operation, Hr. per year	3,600	1,275	1,320	1,000
Maximum demand, Hp. per 1,000 cu. ft. of space	0.296	0.628	0.281	—
Water consumption, Cu. ft. per cu. ft. of space per year	1.88	0.830	—	—
Energy consumption, Kw-hr. per cu. ft. per year	0.388	0.263	0.371	—

†Includes winter conditioning.

contemplated installation will operate are different from those where the sample installation has been installed.

In this report the Institute has published data on approximately 45 typical installations in seven cities throughout the country. These installations have been made in a wide variety of buildings such as banks, hotels, offices, office buildings, printing plants, residences, restaurants, stores, and undertaking parlors. Each installation is reported separately and as much information as possible given.

The report has classified the various installations and makes certain general statements about them which should be of interest.

In the restaurant group it was found that the equipment was operated from 1200 to 4000 hr. per season, consuming from 600 to 1400 kw.-hr. per hp. per season. The average consumption was 800 kw.-hr. per ton per season. Offices on which information was available varied in size from general offices containing 45 people to buildings housing as many as 1000 people. Current consumption per horsepower per season ranged from 800 to 1200 kw.-hr. with the average being somewhat above 1000.

In the residence group the daily hours of operation vary for different rooms. An overall average of the rooms showed an average number of hours of operation per year of 1200. The current consumption per horsepower per season averaged 900 kw.-hr.

In the department store and large store group the average number of hours operation per season was 1400. Current consumption per horsepower per season was 1100 kw.-hr.

Some of the more important information has been arranged in tabular form and appears on these pages. The table for restaurants includes information on all types of eating places—from lunch wagons to large hotel dining rooms. The table on stores covers all types from small shops to eight-story department stores.

The last part of the report is devoted to the subject of cooperation with the manufacturers of air conditioning equipment. The chairman of the air conditioning committee got in touch with a number of manufacturers to get their ideas on the best way that the utility could help the manufacturers in promoting air conditioning.

A number of excellent suggestions were made and there seemed to be a unanimous opinion that the utility should in some way act as a checking bureau to insure that a good installation be made.

Air Conditioning Increases Department Store Business 6%

THE results of completely air conditioning Filene's Department Store in Boston were recently discussed by Richard Brunel, construction engineer for the store, before the Air Conditioning Bureau of Boston. The following has been abstracted from his speech:

Customer reaction was generally favorable, many persons who had been accustomed to shop at other stores noticing the difference, once tried, and then transferring their shopping to the Filene air conditioned store. While general retail business in the Boston Federal Reserve District was up 10% in July, Filene's business increased 16%, and it is fair to attribute at least 6% of that increase to the air conditioning more than anything else. In the public restaurant the figures were especially significant.

Usually summer business in this department is below normal. But following installation of the air conditioning, one month showed a 70% increase over the corresponding summer month and another month 40%, with the average increase, therefore, about 50%.

Summer soilage of merchandise, due to open windows, more dust and trying on by persons perspiring brings heavy loss in certain departments. This loss was noticeably less, due to the filtered air, especially with light colored materials. As for publicity, the speaker said that verbal publicity, word-of-mouth, and talk over bridge tables extended far into Vermont, New Hampshire, and even into Maine. It was a frequent subject of conversation over bridge tables, as the management had learned. This verbal publicity was deemed worth as much as the continuous mention in the newspapers.

Figures on operating costs are yet sketchy. For refrigeration (which, of course included dehumidification as necessary) from March 1 to July 31 required 1,720,000 cu. ft. less water than was previously used with the old basement cooling plant, now tied in with the rest of the store. This was due to the cooling tower. The following table gives an idea of operating costs.

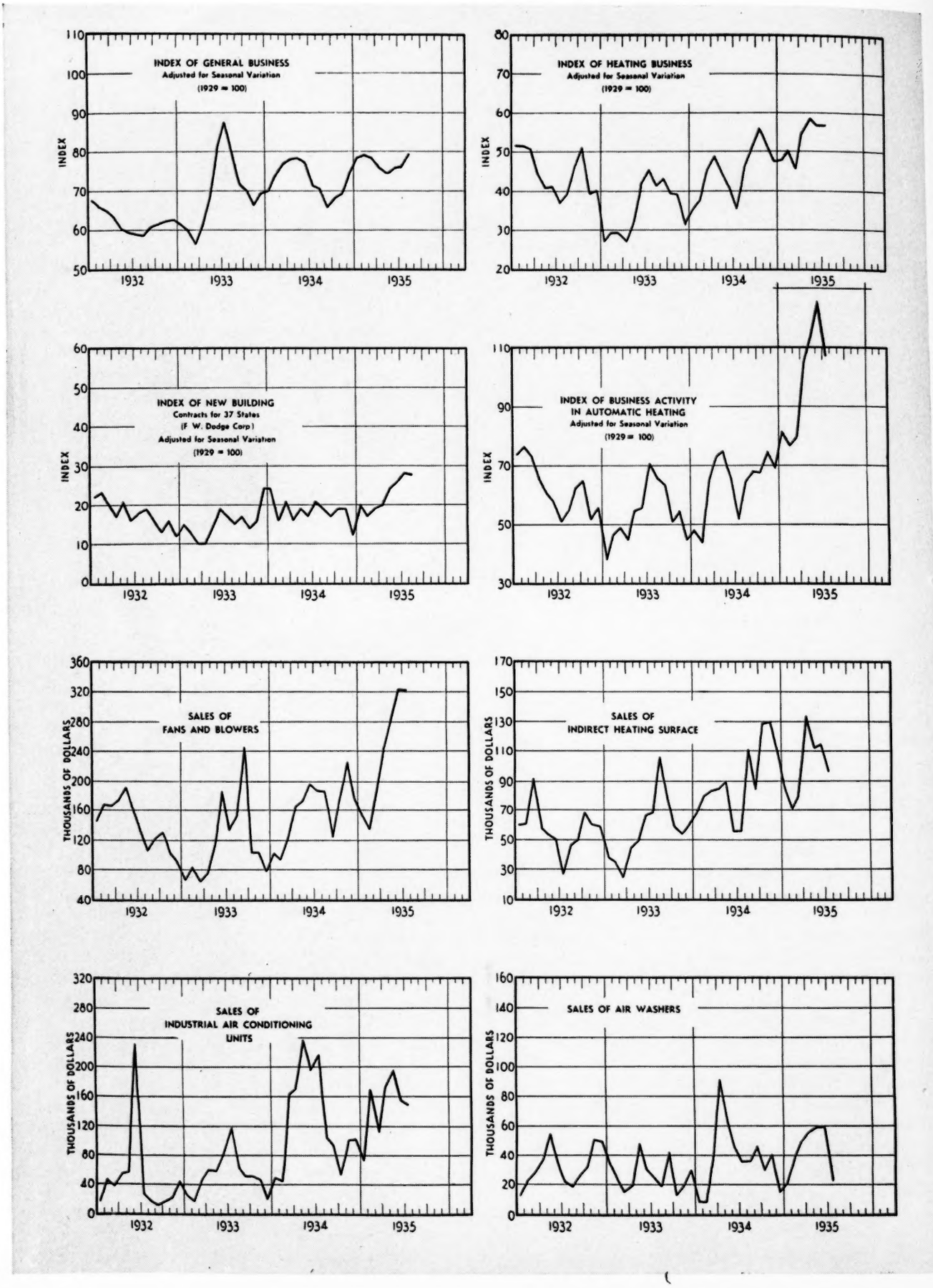
June—25 selling days, 206½ hr. of selling, 238 2/3 hr. of refrigeration—166,224 kw-hr.; 140,100 cu. ft. water; total cost, entire store, without depreciation (amortization), $3,949.

July—22 selling days; 176 hr. of selling, 228¼ hr. of refrigerating—235,000 kw-hr.; 180,000 cu. ft. water; total cost without depreciation, $5,709.

August—22 selling days; 176 hr. of selling, 219¾ hr. of refrigeration—228,000 kw-hr.; 165,000 cu. ft. water; monthly cost, without depreciation, $5,524.

These figure out per square foot, for the 366,000 sq. ft. of area conditioned, 1.08 for June, 1.56 for July, and 1.51 for August. The estimated per square foot cost per year, for the entire store, without allowing for depreciation is nine to 9½ cents per square foot.

BUSINESS TRENDS



Heating Business Up 60% Over Last Year; Building Up 50%

ACCORDING to HEATING & VENTILATING's Index of Heating Business the industry as a whole did about 60% better business during July than during the same month a year ago; building for August was up about 50% over the same month in 1934, while the air conditioning installations for August as reported by 17 utilities, shows about 50% more jobs installed at only two-thirds more horsepower. However, for the first eight months of 1935 the air conditioning business shows an increase in the number of jobs and about the same horsepower as during the similar period in 1934.

Although HEATING & VENTILATING's Automatic Heating Business Index showed a drop from June, the July figures still indicate an increase over 1929 levels. This is due both to an increase in the number of oil burners and the number of residential stokers being installed.

It is interesting to note that 1935 air conditioning installations in Washington are running about 75% of the total for last year, nearly 7,000 hp. having been installed in the first eight months of this year as compared with over 9,000 hp. in the eight months of 1934.

In spite of the trend of air conditioning business air

(Concluded on page 75)

SUMMER AIR CONDITIONING INSTALLATIONS REPORTED BY 17 UTILITIES FOR AUGUST 1935†

CITY	AUGUST 1935		AUGUST 1934		8 MONTHS, 1935		8 MONTHS, 1934	
	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.
Akron	3	15½	0	0	7	57½	8	54½
Boston	10	148	3	2036	46	846	38	2675½
Chicago	31	365	25	222	283	4902	227	4480
Cincinnati	19	325¼	—	—	93	2451½	—	—
Dallas	12	30½	—	—	70	1216	—	—
Detroit	21	137½	—	—	84	2769½	—	—
Hartford	2	6	—	—	14	172	—	—
Houston	6	421¾	4	25½	27	2297¾	27	341
Manhattan and Bronx	31	902	—	—	189	7189	—	—
New Orleans	7	122	—	—	56	2014	—	—
Philadelphia	10	564	17	85	125	3504	100	2125
Pittsburgh	6	29½	—	—	79	1314½	—	—
Queens	0	0	6	36¼	9	161¼	22	268
Scranton	2	35	—	—	8	103	—	—
Syracuse*	4	143	3	28	5	167	3	28
Toledo	4	49	0	0	22	424	0	0
Washington	25	577¼	7	1138	135	6952½	76	9378¼
TOTAL, 17 REPORTS	193	3871¼	—	—	1252	36541½	—	—
TOTAL, THOSE REPORTING BOTH YEARS	93	2283½	65	3570¾	659	19312	501	19350¼

†Dash indicates no report, not that no jobs were installed.
*August figures include July.

HEATING BUSINESS TRENDS AND EQUIPMENT SALES

EQUIPMENT	JULY 1935	JULY 1934	JUNE 1935
Oil burners, number of units shipped in U. S., mechanical draft type	7,454	4,705	7,783
Boiler-burner units, number shipped in U. S.	744	702	837
Ventilating blowers, orders in dollars	81,218	53,905	111,716
Small housed blowers, orders in dollars	58,285	—	48,872
Air washers, orders in dollars	24,350	34,987	58,614
Industrial air conditioning units, orders in dollars	148,669	216,799	156,365
Industrial unit heaters, orders in dollars	226,085	154,323	192,731
Schoolroom unit ventilators, orders in dollars	112,356	195,488	187,129
Non-ferrous indirect heating surface, orders in dollars	88,055	48,225	102,598
Cast iron indirect heating surface, orders in dollars	6,491	7,594	10,968
Residential stokers, sales in number of units	2,868	856	2,417
Steel boilers, orders in square feet of heating surface	146,931	124,644	146,322
Cast iron round boilers, shipments in thousands of pounds	3,647	2,592	2,710
Cast iron square boilers, shipments in thousands of pounds	16,332	11,172	10,700
Cast iron radiators, shipments in thousands of square feet	4,675	3,136	3,462
Non-ferrous convectors, sales in square feet, elements only	81,619	76,660	56,280
Non-ferrous convectors, sales in square feet, with cabinets	166,807	127,993	147,614
Cast iron convectors, sales in square feet	271,623	136,672	245,870
INDEXES (1929 = 100), SEASONALLY ADJUSTED			
HEATING AND VENTILATING's Index of Heating Business	56.5	35.4	56.4
HEATING AND VENTILATING's Index of Automatic Heating	107.4	52.0	125.8
HEATING AND VENTILATING's Index of Heating Contractor Activity	43.9	30.6	37.3
	AUGUST 1935	AUGUST 1934	JULY 1935
New Building Contracts	27.0	19.0	28.0
HEATING AND VENTILATING's Index of Stock Prices, 11 Manufacturers, unadjusted, unweighted	48.3	25.6	43.8

Dehumidifying in Industrial Plant Aids Process

IF the manufacturer of drugs and serums is to continue operations during hot and moist portions of the year he must have some means of controlling the air conditions in his plant. Many drugs and chemicals are extremely sensitive to temperature and moisture changes and have to be kept in conditioned rooms if they are to remain in their original state. When the moisture content of the air increases the drugs absorb water and clog up the machines which are used to form them into tablets. Then too, increased moisture and temperature will render the gelatin in the capsules, which are used to hold many drugs, soft and unfit for use.

The Lederle Laboratories, Inc., Pearl River, N. Y., manufacturer of a wide variety of drugs and serums, has in the past often encountered considerable difficulty because of the weather conditions and at times has been forced to shut down some departments during the summer months.

Since the maintenance of low humidity is an extremely important factor, certain rooms were in the past partially conditioned by drying the air. This was done by passing the air through beds of charcoal in a large iron cylinder. After the charcoal had absorbed a considerable amount of moisture it was reactivated by passing hot flue gases from a gas burner through it. There was, however, no means of cooling the air and these rooms became extremely warm. Then too, the operation of the dryers was not fully automatic and always required more or less attention.

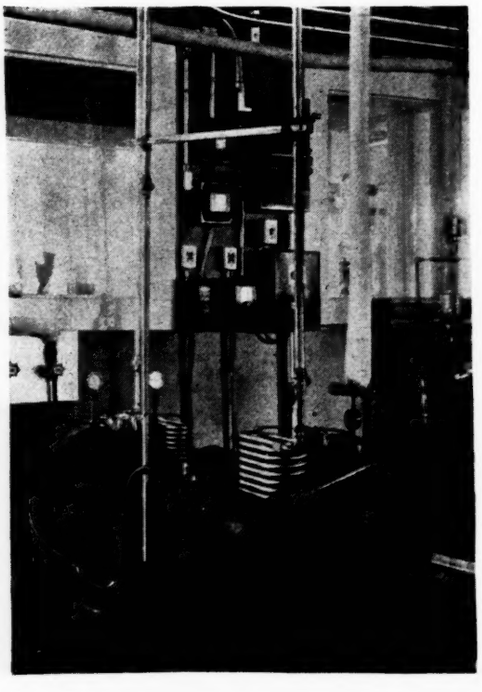
In some of the rooms it is necessary to have absolutely clean air. This is true particularly in the sterile filling rooms where capsules and vials must be filled under absolutely sterile conditions. The rooms are small with space for only one girl at a time. The duct supplying air to these rooms has a cloth bag at the outlet which provides some degree of filtering. There is no provision for cooling the rooms, however, and at times the rooms became extremely warm.

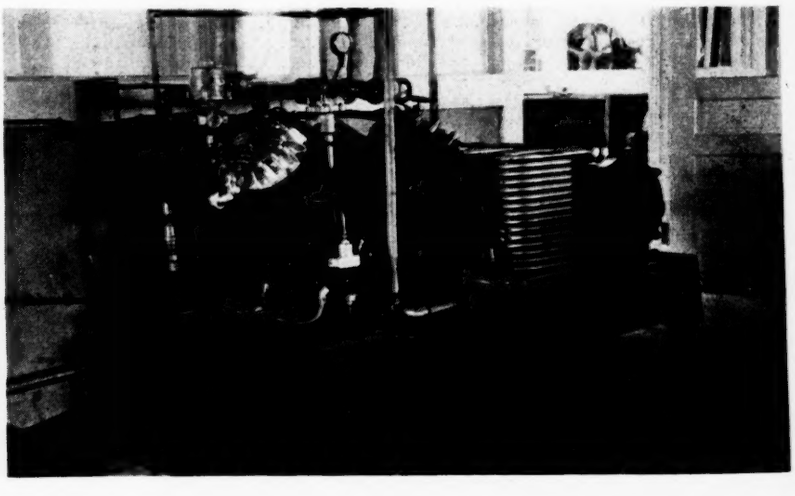
Thus when an increased demand made necessary an extension to the Pharmaceutical Laboratory it was decided to air condition a number of rooms to improve both the manufacturing and working conditions. The extension is a two story, cinder block building finished on the outside with a rough cement surface. There are a large number of steel frame windows in the building and those in the air conditioned rooms are sealed shut. No special provision was made to insulate the building.

To reduce both the initial and operating costs, only certain rooms were air conditioned. It was not deemed necessary to condition such rooms as the library, halls and certain storage rooms. The other rooms in the extension are served by three separate systems. This was made necessary by the fact that different conditions are maintained in various rooms.

In all the systems the refrigerating machinery is located on the ground floor and the refrigerant, methyl chloride, is piped to the various air conditioning units suspended from the ceiling of the rooms which they condition.

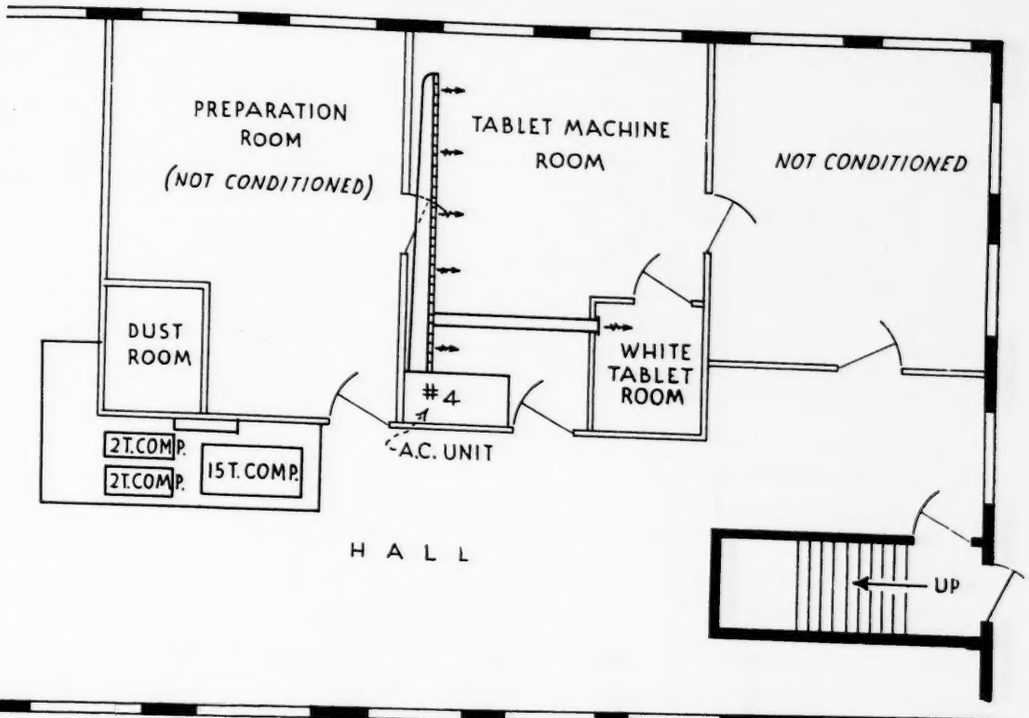
The first system furnishes conditioned air to the tablet machine and white tablet rooms on the first floor and the filling and packing room, sterile filter room, 4 sterile filling rooms and hall, test room and two offices on the second floor. There are four air conditioning units in this system, all of which receive liquid refrigerant from a 15-ton methyl chloride com-

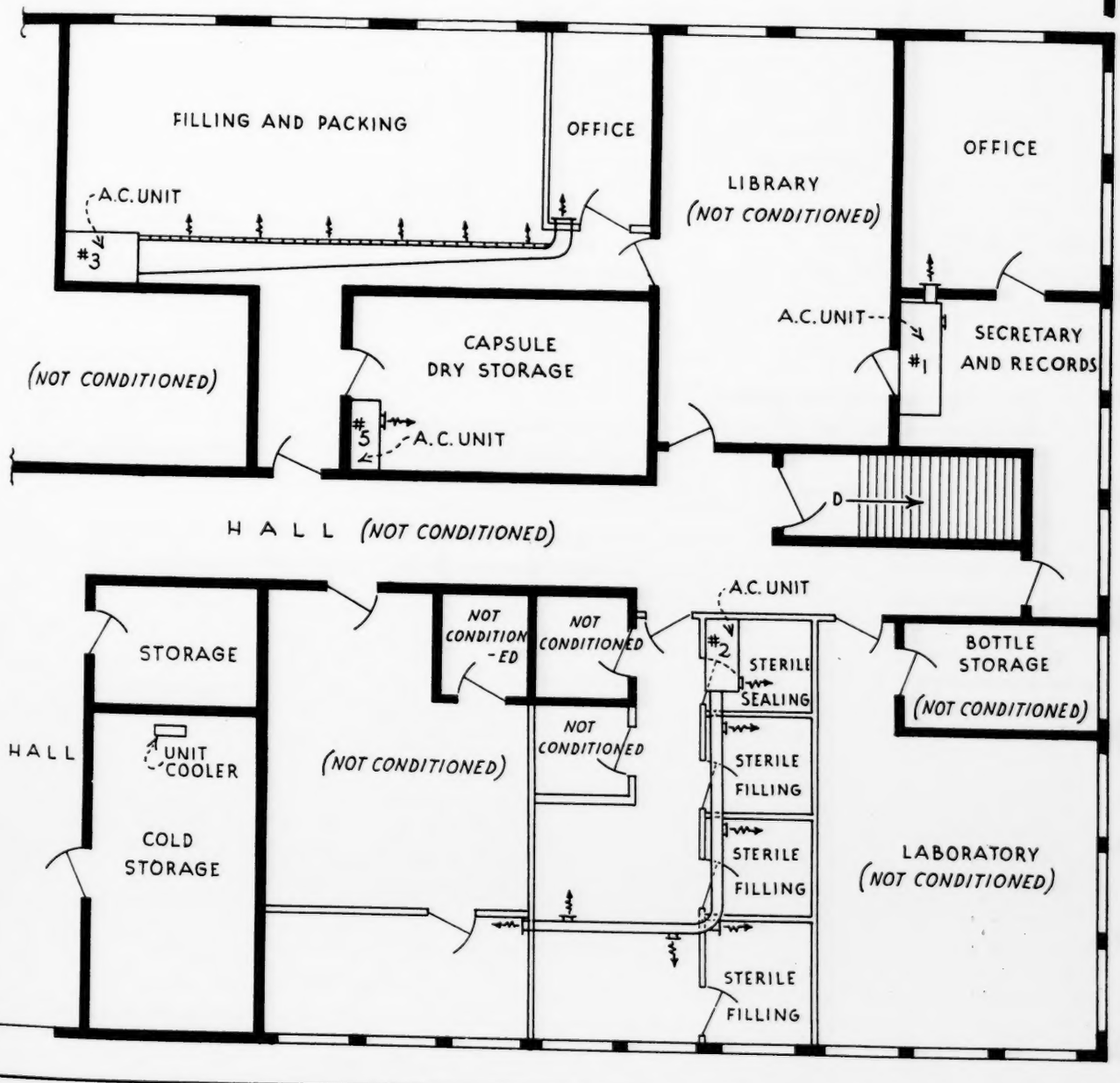


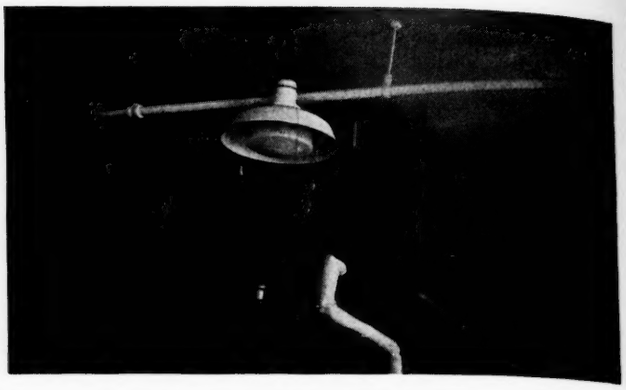


(Left) Two two-ton methyl chloride units which compress the refrigerant for the air conditioning units in the capsule dry storage room and the cold storage room. (Below) The 15-ton methyl chloride compressor which supplies the four air conditioning units in the first system with refrigerant. All of the compressors are in the hall on the ground floor.

(Right) A section of the ground floor. Only the tablet machine and white tablet rooms are conditioned. The three compressors are located in the hall in front of the preparation room. (Below) A section of the second floor. Rooms not conditioned are so marked. Partitions designated with a double line are of wood with large areas of glass in them, those shown with heavy line are of solid construction.







(Left) Air conditioning unit which is located over the door of the tablet machine room. Slotted duct in upper corner runs the length of the room. Branch duct carries conditioned air to the white tablet room. (Right) Conditioning unit in the filling and packing room. At the right is the air inlet duct and at the left the air distribution duct.

pressor on the first floor. The system is designed to maintain a temperature of 80° and relative humidities between 35 and 45% in these rooms when the outside temperature is 95° with a 75° wet bulb. Each conditioning unit has an individual control on it so that the conditions maintained by any unit can be independent of those of the other units.

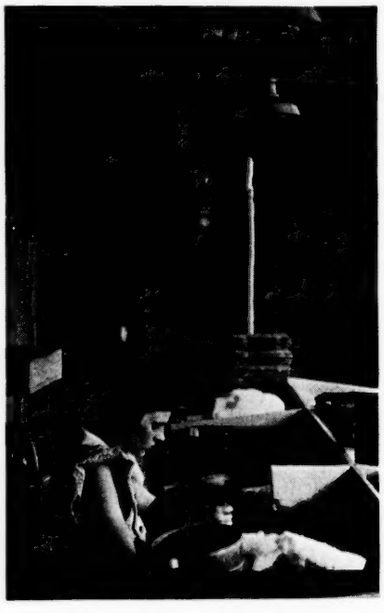
All four of the units are ceiling mounted to save space. The units consist of a blower, air filter, heating and cooling coils, and the necessary controls. A drain pipe is provided to remove the condensate from the cooling coils.

Unit 1 is located in one corner of the secretary's office and cools both this and the main office. The main objective in this case is to provide comfortable working conditions.

The second unit of this system cools the four sterile filling rooms as well as the test and filter rooms and a small hall. A duct runs from the unit which is located in the end sterile filling room through the other filling rooms, the filter room and into the test room. As was stated previously the principal objective in conditioning the sterile filling room is to provide clean air. The control of temperature and humidity is of secondary importance and is only to provide more comfortable working conditions. Doors leading to these four rooms have a 1 in. opening at the bottom for exhaust air.

This exhaust air from the sterile rooms enters the sterile filter room and with the additional air provided by the duct cools both this space and the hall. All doors leading from air conditioned spaces to non-conditioned rooms have metal weatherstripping along the sides and top and a felt strip along the bottom to reduce the amount of infiltration air.

The third unit conditions the filling and packing room as well as the small office in that room. Air conditioning is essential in this room because the gelatin capsules are filled and packed here. Good air distribution is provided by the duct which runs along one side of the room to the register in the small office. The duct has side openings throughout its entire length to distribute the air.



Gelatin capsules are filled and packed in a cool and dry atmosphere provided by the air conditioning unit at the rear of the room.

The fourth unit in this system cools two first floor rooms which house the tablet machines. Air conditioning is essential here to keep the moisture content of the drugs at a constant level. The unit is located over the doorway leading to the tablet machine room. A small duct from the unit supplies air to the white tablet room and another runs the length of the tablet machine room. A large number of openings in one side of this duct provide good air distribution throughout the room.

Only one room is conditioned by the second system. This is the capsule storage room located between the hall and the filling and packing room. In this case the system is designed to maintain a temperature of 75° with a relative humidity of between 35 and 45% when the outside conditions are 95° with a 75° wet bulb. An air conditioning unit of the same type as used in the other rooms is employed to cool this room. The amount of refrigeration needed to cool this room is less than that for the other rooms because there are no windows or exterior exposures and the only glass area is in the door. A 2-ton methyl chloride compressor supplies the refrigerant for this unit.

A liquid cold storage room is cooled by the third system. The system is designed to maintain a temperature of 35° when the outside temperature is 95°. No provision is made to control the humidity. A unit cooler mounted from the ceiling is used to cool this room which is especially insulated and has no windows. The door leading to it is of very heavy construction of the type usually found in cold-storage warehouses.

The switch for the lights in this room is located on the outside wall near the door. A light on the switch shows when the room lights are on.

"Modernize for Profit" Drive Gets Under Way

to stimulate modernizing of the nation's commercial, industrial, and institutional buildings. Loans up to $50,000 insured by FHA under amendment to Housing Act. Air conditioning, heating and ventilating equipment eligible for loans.

AFTER five months of intensive effort the Federal Housing Administration has slipped its "Modernize For Profit" campaign into high gear, and jammed its foot down hard on the gas. Backed by the broad powers of the "$50,000 Amendment" to the National Housing Act, and fortified with a complete set of carefully worked out regulations governing operations under this amendment, FHA is all set for action in its determination to drive home the story of this great opportunity for economical and profitable modernizing to every qualified property owner, building trade, and material manufacturer. There is no time to lose, either, for the benefits of the National Housing Act pass out of the building picture on April 1, 1936.

That air conditioning, heating and ventilating will get far more than a normal share of the beneficial effects of this modernizing campaign is indicated by the fact that equipment of these industries, such as air conditioning installations, boilers, heating systems, ventilators, heat control equipment, and other important items, have been formally approved by FHA as eligible for insured loans on all classes of buildings mentioned in the Act.

To more clearly understand the present "tactical" position of the FHA's campaign for modernizing commercial, industrial, and institutional properties it is necessary to go back for a moment and review briefly what has taken place before. In the late spring of 1934, Congress, in an effort to revive the lagging durable goods industries, and more particularly to instill some sort of life into the as-good-as-dead building trades, passed the National Housing Act, which was approved by the President on June 27 of that year.

This Act provided for the establishment of a Federal Housing Administration. Title I of the Act handed the credit of the Government to the newly-created FHA and by implication told it to get busy and tell people that "now" was the time to modernize properties, particularly homes, and that the Federal Government would help them do the job by putting its insurance guarantee on their obligations so that financial institutions would cash them, thus providing funds for modernizing purposes.

TYPES OF BUILDINGS ELIGIBLE FOR "MODERNIZING FOR PROFIT" LOANS

Apartment houses	Barber shops
Hotels	Beauty shops
Office buildings	Restaurants
Retail stores (all types)	Laundries
Wholesale establishments	Dairies
Store buildings	Commercial airports
Warehouses (storage)	Hospitals
Garage and repair shops	Orphanages
Factories	Colleges
Manufacturing plants	Schools

However, a limit of $2,000 was provided by the Act for any single insured modernizing loan. It was soon apparent that this restriction pretty well limited the benefits of the Act to small residential properties, inasmuch as the modernizing of a commercial or industrial property, in most cases, involved the expenditure of a considerably larger sum. This left a huge segment of the country's structures without the opportunity to modernize under the Act. It followed naturally that this condition also shut off a lot of possible business form the needy building industry. In a recent statement for publication, Major R. B. Lawrence, chief, trade publications section, FHA, said that there is an additional total of 2,525,573 buildings now eligible for modernizing loans. These include:

Apartments	643,779
Hotels	29,462
Retail stores	1,526,119
Wholesale establishments	164,170
Manufacturing establishments	141,776
Institutions (colleges, schools, etc.)	20,267

To provide a remedy for this situation, Congress passed what is generally called the "$50,000 Amendment" to the National Housing Act which was signed by the President on May 28, 1935. This new law not only raised the limit of modernizing insured loans to $50,000 but it also permitted the insurance of loans made for the "purchase and installation of eligible equipment and machinery" to be used in connection with modernizing operations. It also extended the time limit for making modernization loans to April 1, 1936.

It takes little imagination to understand that the addition of the administration of the activities of this amendment to an already overburdened FHA created a problem of large dimensions. As is always the case, everybody concerned wanted action immediately. But quick action was not so easy. The new situation involved not only a tremendous increase of the same type of duties as those imposed by the $2,000 limit modernizing of the original Act, but it added many new and intricate problems. To insure a $50,000 loan with due business precaution is not quite so simple as guaranteeing a $2,000 obligation. Methods had to be worked out with the finan-

cial institutions making such loans that would adequately safeguard the borrower, the institution, and the Government.

Then, too, a brand new lending feature had entered the picture, namely, the loans to be made for *eligible* equipment and machinery. What was eligible equipment and machinery? There were literally thousands of such items to be considered. Which should be O.K'd and which should be left out? Must such equipment and machinery be attached to the modernized structure, thus becoming a part of the realty, or not? What types of equipment and machinery should be deemed to conform with the proper uses of the structure or business to be modernized, was another question that had to be solved.

Bachrach

Stewart McDonald, FHA Administrator since September 1, 1934

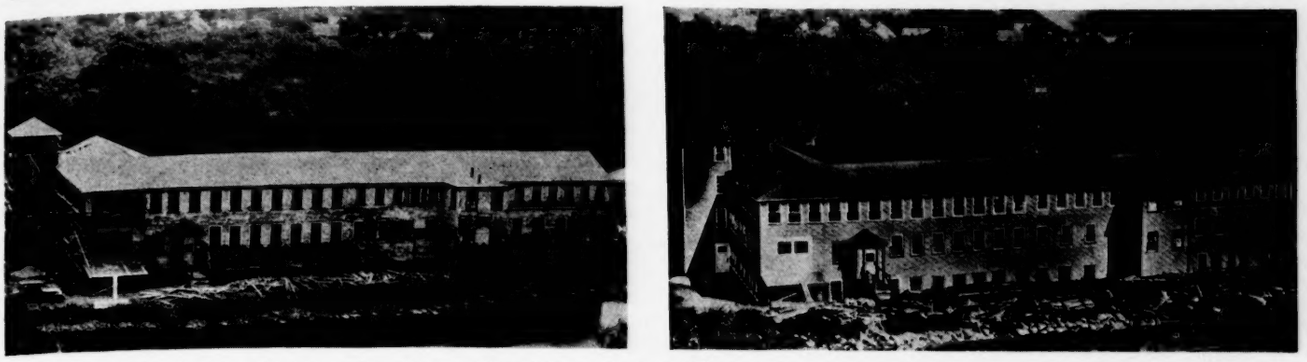
But all of these problems were met. Representatives of building trades, material manufacturers, business papers, and others were called into conferences, and regulations drafted which defined as clearly as possible the types of equipment and machinery eligible under the amendment. Bankers were consulted and procedure established for making the larger loans. Comprehensive plans were formulated for carrying the story of this enlarged scope for modernizing to property owners, and today the campaign is set all along the line for a quick move forward.

The "Modernizing For Profit" movement is geared to benefit four great classes of commerce and industry. First come the financial institutions, banks, building and loan associations, and financing companies all over the country are faced, generally, with the difficult task of lending their funds at a rate that will give them sufficient return to insure a reasonable net profit for their institutions.

Next in line is the property owner or manager. The country has been in a state of depression for the past five or six years. Tenants are none too plentiful and hard to please. Obsolete, or partially obsolete, properties are handicapped by the competition of more modern structures. Merchants on Main Street, and the side streets, too, are faced with a loss of patronage because their stores are not up to the minute in appearance and equipment. Now comes this opportunity to do a first class modernizing job simply by walking over to the bank and selling their story of needed improvement. The Government insures the loans and the property owners start at once to remodel their structures into 1936 models. This they can do under the Act, with their working capital intact, improvement payments being made over a period of up to five years from increased income accruing from their improved structures.

The opportunity presented to the building trades and to material and equipment manufacturers comes as a consequence of the bringing together the property owner and his financial institution, brought about by the Federal Housing Administration's modernizing

A typical example of modernizing work on a type of building eligible for the up to $50,000 loans—theaters.



A Massachusetts factory before and after modernizing. Industrial plants can not only borrow money for improving the structure but also for such manufacturing equipment and machinery as is eligible under the Housing Act amendment.

drive. Remodeling and equipment installations mean building labor and material purchases. The situation is a "natural," and aggressive contractors and manufacturers will be quick to see this and take advantage of it.

In addition to the extensive publicity program that has already been put across, the Administration has just published a handsome illustrated booklet: "Loans Up To $50,000 To Modernize Under The National Housing Act." This booklet is a strong piece of selling literature keyed for the attention of the property owner, urging upon him the advantages of modernizing his property or business under the plan offered. More than a million copies of this pamphlet will be placed in the hands of interested parties within the near future.

FHA has also actively under way modernizing exhibits showing, or to be shown, at more than 700 fairs throughout the country. These exhibits will bring a visual story of the advantages of modernizing to many millions of urban and rural citizens. Furthermore, with the cooperation of the U. S. Treasury Department, which is engaged in a collateral movement to stimulate private building and employment, the formation of a Council of representatives of the durable goods industries was sponsored at a recent meeting held in Washington by representatives of the FHA, the Treasury, and the industries involved. The membership of this Council will be made up entirely of industry representatives. The chairman, elected at the meeting, is Russell G. Creviston, Crane Company. The vice-chairman is Marshall Adams, American Radiator Company. The purpose of the Council is to cooperate with the Government agencies in their work of putting this modernizing campaign across. One of the matters discussed at the recent meeting was the possibility of inaugurating a fleet of motor trucks equipped with modernizing exhibits to travel about for show purposes. A series of exhibits in nine key cities to demonstrate moderate housing costs, materials, and modern appliances and equipment was also slated for arrangement by the Council.

Harris & Ewing

Arthur Walsh, Deputy Administrator in charge of all modernizing activities of FHA

Following are some of the salient features of the FHA plan:

Financing

FHA does not make loans. It insures private financial institutions, in conformance with the Administration's requirements.

The loan arrangement is made between the prospective borrower and the financial institution with which he negotiates his loan. Interest rates, amount of monthly payments, period for which the loan runs, and other lending details, including the security to be used, are matters of negotiation between banker and borrower. A carefully prepared table of maximum charges permitted by the Government for loan periods up to five years has been prepared and is available from FHA officers, or from the bank. The FHA also requires that notes shall be payable in equal monthly installments.

The question of the financial condition of the borrower is left to the reasonable judgment of the lending institution, but each borrower must furnish such institution with a financial or credit statement, approved as to form by the FHA, which in the judgment of the lending concern, shows the borrower to be solvent.

A loan will not be insured that has been made to liquidate or replace a previous obligation that was not insured.

A loan in excess of $2,000 but not to exceed $50,000 will be insured only if made for one of the following purposes: For repair, alteration, or improvement of real property already improved by, or to be converted into, apartment or multifamily houses, hotels, office, business, or other commercial buildings, hospitals, orphanages, colleges, schools, or manufacturing or industrial plants; purchase and installation in connection with the foregoing types of property, of such equipment and machinery, with or without any

An office building of the Victorian period converted by modernizing into a modern structure. It is estimated that there are over a million and a half stores in this country, the vast majority of which require modernizing of some kind.

structural changes in the buildings, as are peculiarly adapted to the business conducted therein or necessary to the operation thereof. Loans in excess of $2,000, to be insurable under the Act must cover projects contracted for *after* May 28, 1935.

Any borrower may obtain any number of insured loans to improve any number of separate pieces of property provided that not more than $50,000 is expended on any one piece of property, and assuming of course, that the borrower's credit standing justifies such borrowing. A qualified borrower may be any individual, partnership, corporation, or association, who makes application for a loan upon a form approved by FHA, and whose application is approved by a financial institution operating under a contract of insurance issued by the Administrator.

The credit statement required in applying for a loan in excess of $2,000 must disclose the necessary data upon which the insured institution may make a decision as to the credit responsibility of the applicant; it must also contain a description of the property to be improved, and of the improvements or installation to be made thereon, and of the applicant's right of occupancy thereof. The applicant need not be the owner of the property.

Eligible Equipment and Machinery

The following applies to eligible equipment and machinery other than that which becomes a permanent fixture of the real estate and is therefore eligible as an improvement to the real estate itself.

It is of course impossible for the Administration to list all other articles which might be eligible under the new amendment, as the items number many thousands. Omission of an item from the published lists issued by the FHA is, therefore, not conclusive proof that it is ineligible. If in doubt a manufacturer should submit the matter to FHA at Washington or to one of its field division offices.

Loans for equipment and machinery of whatsoever kind installed in buildings other than Class A type properties may not exceed $2,000. Loans for appropriate equipment and machinery installed in Class A properties may be for any amount up to $50,000.

Eligible equipment, already approved by FHA, include air conditioning equipment (including humidifiers), built-in ventilating equipment (including built-in fans), heating systems (non-portable), automatic heat devices such as gas burners, oil burners (including fuel storage equipment), and installed stoking and ash removal equipment, radiators, if part of the heating system, including valves and accessories; automatic heat control devices, such as thermostats and pressurestats, unit heaters (non-portable) and heat circulation devices, if built in. All of the above are eligible for homes, with insured loans not to exceed $2,000. Loans up to $50,000, for any of the above equipment to be installed in apartment houses or multiple-family dwellings, are also insurable under the Act. In general, the following types of equipment are eligible for insured loans for any installation in a Class A structure: air conditioning, boilers, heating systems, and ventilating systems.*

If any manufacturer or contractor would gear himself actively into this huge movement to open up the modernizing field he should first contact some FHA office either in the field or at Washington, and familiarize himself more in detail with the methods of operation employed. Next he should acquaint himself with the financial institutions in his community that have been approved to make loans insurable by the Administration. Lists of approved financial institutions are available at FHA offices. He is then ready to go into the field and look for logical prospects, who may be introduced into the plans formulated. The rest is a matter of sound salesmanship.

FHA's original modernizing loan program set a record during the week ending September 14 during which 25,172 loans worth $8,900,494 were insured. This brings the total of insured modernizing repair notes under $2,000 since the beginning of the program to 401,292 valued at $149,111,551.

*For a detailed examination of this subject reference should be made to FHA's booklet No. 145, titled "Equipment and Machinery Eligible for Modernization Credit." This pamphlet may be obtained at Washington or from any FHA field office.

Cool, Dry Air Improves Luster of Jewels,

increases business of Fifth Avenue firm which modernized by installing air conditioning units

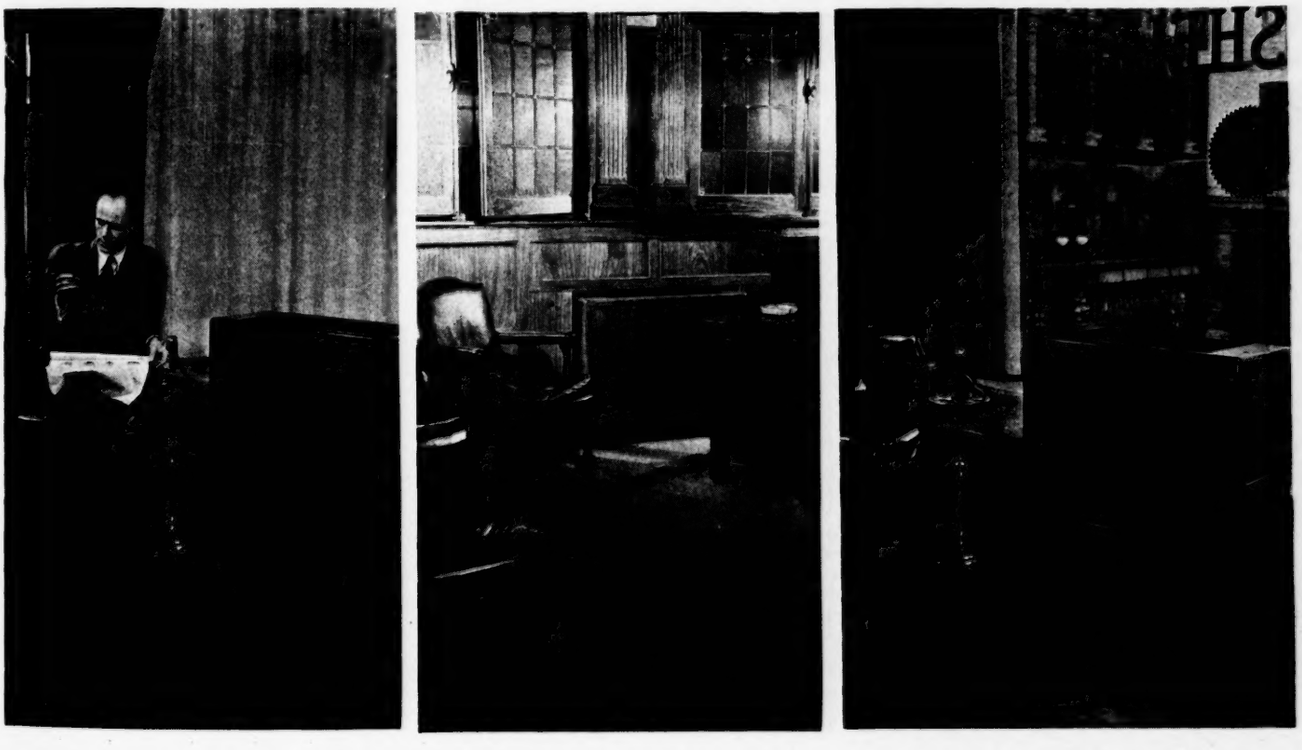
ALTHOUGH most merchants who have adopted comfort cooling have done so to offer added accommodations to customers, a prominent New York jeweler, Trifari, Krussman & Fishel, Inc., ordered three conditioner cabinets with still another object in view. This had to do, it is said, with the tendency of precious stones, especially pearls, to lose their gleaming, attractive luster during the hot humid days of July and August. Previously, when salesmen of the firm spread before prospective buyers in the summer the pieces most desired to sell, the customers frequently were not well impressed due to failure of the jewels to shine as they should.

Three air conditioners of the cabinet type were installed, one at the front, one in the center display room, and a third in the private office in the back. Two of the units have heating surface, but the third unit is strictly a cooling unit with suitable drainage connections.

Like many wholesale and retail Fifth Avenue jewelry stores, this concern is located on the second floor. The avenue exposure is but 40 ft., the depth of the establishment being 100 ft. Previous to the modernization, ventilation of a sort was obtained by opening the front windows. Although there is a window in the back this has been closed for several years. The open window method permitted the infiltration of annoying quantities of dirt and noise and never proved satisfactory.

Now all windows are permanently closed, although a definite quantity of outside air enters from the stairway opposite the front door. Refrigeration required for the cooling coils of the conditioners are two tons for the front and intermediate units and one ton for the rear unit. Air changes range from two to three per hour, relative humidity rarely exceeds 45%, and about 12° cooling effect is produced throughout.

Modernization earned its cost in added patronage last year and continues to do so this year. Wandering away and casual visits of purchasers have ceased and folk who formerly deferred buying jewelry in summer due to shopping discomfort now patronize the store in summer as well as winter, visits being prolonged sufficiently for salespeople to show the entire line and bring out the respective merits of all items. Last year's business is reported to have increased 23% above that of the previous year.



(Left) Customer inspecting jewelry under comfortable conditions in display rooms of Trifari, Krussman & Fishel, Inc. (Center) Air conditioner in private office of the jewelry company. (Right) Conditioner in front display room.

Reducing Operating Costs by Changes in Mechanical Equipment

By G. KENDRICK BRINGHURST†

This is the fourth article of a series by Mr. Bringhurst in which he presents the case histories of different type buildings in which modernizing of the plant has resulted in a definite return on the investment to the owners.

A SUBURBAN property, consisting of owner's residence and a greenhouse, each heated by gravity hot water from manual oil fired boilers, used 31,700 gal. of No. 5 fuel oil costing $1347 during a 5000 degree-day season. The cost of gas for cooking and heating domestic water in the residence was $487 for 488.4 thousand cubic feet during the corresponding 12 months. Heating, hot water generation, and cooking cost $1834 per year for fuel.

The residence, occupied by eight adults, including five servants, contained about 175,000 cu. ft. of heated contents, three stories high, built of stone and tightly constructed. Radiator surface was made up of 1270 sq. ft. direct cast iron in the third floor and servants' wing, 4220 sq. ft. of indirect cast iron in the basement to supply heated air to the first and second floors, and 620 sq. ft. measured loss from the piping mains and branches, all of which were well insulated. Although the total equivalent direct radiator surface was 6110 sq. ft., the boiler output was limited by the 4000 sq. ft. rated oil burner, while the boiler rating was about 5000 sq. ft.

Heating was unsatisfactory because of the undersize boiler unit and the long runs of piping. To provide sufficient head of water on the basement indirect radiators and piping, the main supply from boiler had been looped up to the third floor and then down again to the basement mains. Each of the two basement supply mains was 180 ft. long, and including runouts and risers the water travel from boiler header to the farthest radiator and then back again to the boiler was over 500 ft. Such condition resulted in sluggish circulation and considerable drop in water temperature at the ends of mains.

The original installation had included two fresh air ducts with connection to each of the 41 indirects, but these ducts had been subsequently removed by the owner, who figured there would be less oil used if all of the air supply was taken from the basement. There was no provision for recirculation from the rooms supplied by heated air. Using air supply from the basement, the center and south end of the house heated fairly well, but on cold days the north end could not be heated. With a north wind and an outdoor temperature of 15°-20°, the north rooms could not be heated above 50°-55°. In order to have the first floor comfortable by 7 a.m., the caretaker started the oil burner at 5 a.m., and in severe weather at 4:30 a.m. Although there was a second cast iron boiler similar in size to the oil fired unit, this second boiler was equipped with coal grates, as a spare, and was never used.

In the greenhouse there were cast iron pipe coils with caulked joints, the total load being about 4000 sq. ft. During severe weather, the manual oil burner was in use 24 hr. per day, to prevent freezing and injury to plants.

With no thought of decreasing operating costs, the owner asked for recommendations to make the heating satisfactory throughout, in accordance with which the following changes were made in the residence:

A cold air duct was installed, with connection to each of the indirect radiators supplying the north rooms, and a bypass from the basement was provided at the fresh air intake.

The spare boiler was provided with a full automatic horizontal cup oil burner, of size to develop the full capacity of the boiler. As this boiler had not been in service for ten years, it was taken down, the surfaces wire-brushed and thoroughly cleaned, then reassembled.

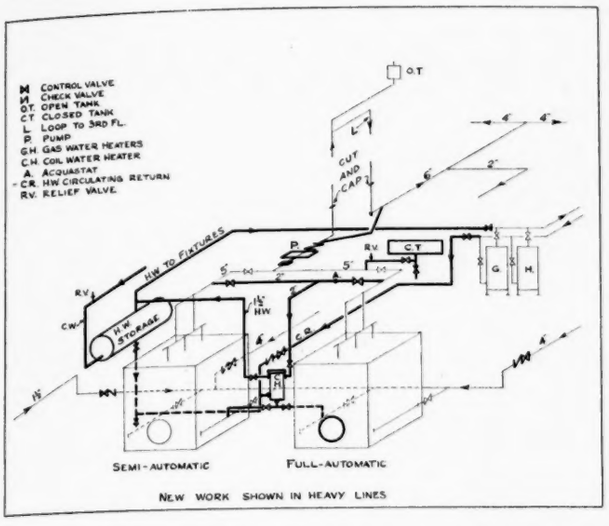
To supply domestic hot water with the oil fired boilers, an indirect coil water heater was provided, with valved connections to the supply and return of each boiler, and an insulated tank of 144 gal. storage capacity was provided. The two existing automatic gas water storage heaters were disconnected, but as they had no resale value because of their large size, they were retained as spares.

The existing loop to the third floor was discontinued, and a 3-in. booster pump and non-return valve were installed in the main supply from boiler header. The pump was controlled from a thermostat placed in the north end of the second floor hall. Gate valves in each return main were provided, to regulate the flow in accordance with the heating requirements. The oil burner control was from an acquastat in the boiler supply. The open tank was replaced by a closed expansion tank, located in the basement.

With these changes, the new automatic oil burner was used to supply 8½-month heating and 12-month hot water. When the outdoor temperature dropped to 20° or under, the old semi-automatic oil burner was placed in operation for about three hours every morning, after which the full automatic oil burner carried the load alone.

Balancing the flow in each main and at each radiator according to the heating requirements was done after

†Consulting Engineer, Philadelphia.



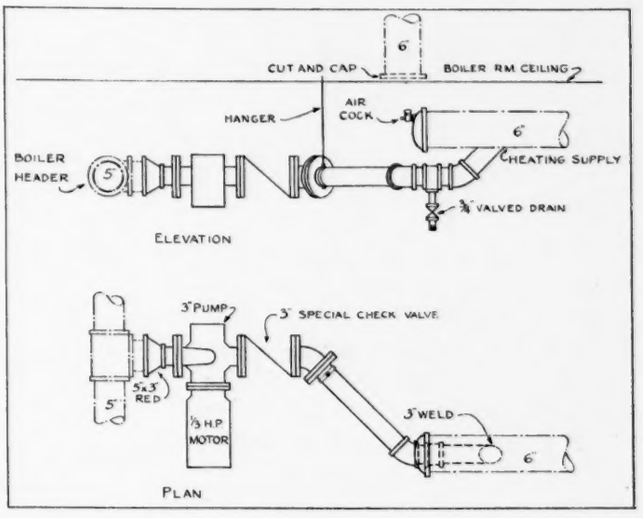


Fig. 1. (Left) Changes made in the boiler room layout. Fig. 2. (Right) Details of pump connection.

cold weather arrived. Some valves, at radiators near the source of supply, were throttled from five full turns open to one-quarter turn open. In the case of large rooms on the south side of house, supplied by two or more indirects, one or more of these were closed off entirely. Valves at the ends of mains remained full open. The required temperatures, to the satisfaction of the owner, were finally obtained in the 29 spaces heated by warm air, and in the 22 rooms heated by direct cast iron, through the adjustment of some 80 valves.

In the greenhouse, a gas line was run from the residence, and the necessary controls provided at the existing manual oil burner to convert it to full automatic, and the pipe coil radiation was balanced in the four sections of the greenhouse, through the throttling of the existing supply valves according to the temperature requirements of the different kinds of plants. The greenhouse oil burner changes were made at a cost of $175.

The cost of making the changes in both the residence and greenhouse, not including certain necessary repair items which had no particular bearing on oil consumption, was $2300.

During the year following the changes, the oil consumption for the two buildings, referring to the same degree-day base as formerly, was 27,500 gal. for heating and hot water. Based on the same 4¼ cents per gal. price of No. 5 oil, the oil cost $1169, a saving of $178 as compared to the previous season for heating only. The cost of gas in the residence, now used only for cooking, was $158, a saving of $329. The total saving in fuel oil and gas was therefore $507.

The division of oil and gas use for the 8½-month heating and the 3½-month non-heating seasons, was:

	Before Changes		After Changes	
8½-month.	31,700 gal. oil.....	$1347	26,600 gal. oil....	$1131
	368.4 M cu. ft. gas..	368	106.3 M cu. ft. gas.	114
		$1715		$1245
3½-month.	120.0 M cu. ft. gas..	$119	900 gal. oil.....	$38
			40.1 M cu. ft. gas.	44
				$82
	Total	$1834	Total	$1327

Actually, however, the saving was greater, as the residence was now well heated throughout, not possible formerly because of the limited boiler supply and gravity circulation. The greatest oil saving was in the greenhouse, where, due to the natural radiation from the sun on clear days, the automatic oil burner was in use only about one-half the time as compared to its previous use when operated semi-automatic.

Seaweed Insulation

Reports from Germany tell of the considerable progress made in recent years with the development of various materials as heat insulators. One of the oldest materials used to insulate rooms against heat, cold, noise, etc., is seaweed. A firm in Hamburg is stated to have started the manufacture of insulation matting formed of seaweed. The matting is made of freshly prepared seaweed, quilted between sheets of impregnated, waterproof paper.

Matting of this kind, with a thickness of about ½ in. has an insulating value corresponding to that of a brick wall 4½ in. thick. Such matting is light, weighing only one quarter as much as other insulating materials, it is claimed. It is reported to have the further advantage of being resistant to fire, since seaweed does not burn and can only be brought to a point of glowing without emitting a flame.

Modernizing School Heating and Ventilating Systems

By CHESTER J. SCANLAN† and R. V. JORDAN‡

DURING the last decade great progress has not only been made in the equipment, but also in the design or application of this equipment to school buildings. A heating and ventilating system that was perfectly adequate five years ago may now be as antique as to design and operating efficiency as the motor car of the same vintage. Some persons do not place much importance on heating equipment; for them anything that will keep them from freezing at "5-below" is good enough. But when a school board is confronted with a building project, one of the first questions which should be asked is, "What Heating System Design Shall We Use?" The heating system should be planned from the standpoint of pupil health and operating economy. This question should be answered by a competent engineer and not left to hit-or-miss methods.

It is safe to say that the majority of existing school heating systems cost approximately twice as much to operate as they would if proper engineering principles were applied in their design. This situation presents the engineer with a wonderful opportunity to demonstrate his ability.

The Central Grade School, Centralia, Ill., is an interesting example of what can be done in an existing building. The old heating plant, with five warm air cast iron furnaces, was of the central blast type. Air was drawn in through the ducts on each side of the entrance door. From the blower, belt-driven by a 7½-hp. motor, the air was forced through a tunnel beneath the basement corridor floor under the furnaces and then up through ducts to the various rooms.

The first grade room was unsatisfactorily heated and was unoccupied from the first cold days in fall until spring. On windy days the rooms on the windward side of the building were cold, while those on the lee side would over-heat. In addition, the system was dirty, as soot and smudge were distributed by the air.

TABLE 1—AVERAGE COST PER SCHOOL DAY

Year	Type of System	Cost per School Day
1931-32	Furnace System	$4.52
1932-33	Furnace System	$4.15
1933-34	*Changed to steam system in midst of year*	
1934-35	Unit steam system	$1.33

†Mechanical engineer, Bloomington, Ill.
‡Superintendent of Schools, Centralia, Ill.

The new system designed for this building is unique in that the steam supplied to the unit ventilators is controlled by a thermostat (one in each unit ventilator) located in the entering air stream. The convection heaters installed to heat the rooms are controlled by means of direct control valves.

The unit ventilators introduce 300 c.f.m. of fresh outdoor air per classroom at all times. From the ventilating standpoint this has been found satisfactory in operation.

Controls are so arranged that when the outdoor temperature is 60° the entering air temperature is 60°, and as the outdoor temperature becomes lower the air temperature increases to a maximum of 100° at an outdoor temperature of plus 10°.

Operating expenses for several years past were as shown in Table 2.

The total ventilating load with the old furnaces was (for 0° to 70°) 817,000 B.t.u. per hr. The heating load for convection heating was 401,400 B.t.u. per hr., making a total load of 1,218,400 B.t.u. per hr.

With the unit ventilators the ventilating load was 204,000 B.t.u. per hr., which made the total load 605,411 B.t.u. per hr. At first glance this seems to be the explanation for the reduction in fuel consumption, but referring to the table the difference in coal per degree-day is to be noted.

Based on 12,000 B.t.u. per lb. coal and an overall efficiency of 60% the 1931-32 heating season calculates 112 tons. On the same basis the 1932-33 heating season fuel requirements were calculated at 123 tons.

Part of the difference shown in the table lies in the time required to operate both plants in order to heat the building.

Based on coal at $4 per ton Table 1 is interesting as it shows the average cost per school day.

TABLE 2—OPERATING EXPENSES

Year	Degree Days	Coal per Season, Tons	Coal, Lb. per Degree-Day	Electric Power	Current Light
1931-32	4508	106.9	47.50	$198.01	$154.99
1932-33	4987	125.2	51.30	$124.61	$149.18
1933-34	*Furnace system changed to a unit steam system*				
1934-35	5798	58.12	20.00	None	$120.28

Modernizing One-Pipe Steam Heating Systems

HEATING contractors have wonderful opportunities at present in the overhauling of old time, one-pipe steam heating systems that are known to have given unsatisfactory service during the last heating season. Such systems are as a rule not only fuel wasters but are also inadequate in room temperature control and equality in the distribution of steam to all rooms. Unequal steam distribution is usually most pronounced in oil, gas, and stoker-fired installations because of their off-and-on action. The result frequently is overheating some rooms while others are underheated.

Remedies to apply in overhauling such jobs depend on the kind of troubles that actually have been found to exist, and they vary with different jobs. In every case the contractor has to do some thinking before he starts. Guessing won't bring results. He must put his finger on the exact spots that give trouble. Then he must plan methods for correcting them, depending on the amount of money owner is willing to spend.

Consider, for example, a practical trouble frequently experienced in some automatically fired one-pipe steam heating residence plants. The thermostat is in the living room over the boiler. The living room radiators are the first taken off the main. The living room then gets steam first and its radiators may be fully heated before steam reaches the furthest radiator. The living room quickly heats up to shut-off temperature, perhaps before the furthest radiator is fully hot, and long before that room is heated. The heater then shuts down, and the most distant radiator cools first, the living room radiator still receiving some vapor from the heater.

Changing the thermostat setting, or even changing its location, cannot remedy the trouble because of the unequal distribution of the steam. The logical remedy is to provide means for correct steam distribution to all radiators. This cannot be handled at the boiler, but it can be handled at the radiators by adjusting the outlet of air from the radiators exactly in accordance with the requirements of the job, some radiators requiring the air passage to be throttled down while others demand various sized openings, the least heated radiator being left with full open port.

Such radiator air valves are on the market and when correctly adjusted on the job, they will equalize the steam flow to all radiators so that all rooms will be up to thermostat room temperature when the heater is shut down, and should not be too cold before the heater starts up again. In this way heating throughout the whole house may be fairly well equalized. To hasten the steam flow through long mains it is advisable to install on the far end of each main an extra large quick vent. This will aid in hastening the heating of all radiators as the air content of the steam mains will be mostly exhausted through the quick vents, leaving the radiator vents free to handle their own radiators.

Garage Becomes an Air Conditioned Night Club

ONE of the most unusual modernizing jobs made in Boston recently has turned a one-story garage into a night club. The conversion was made possible by the installation of an air conditioning system which maintains a comfortable temperature in the club at all times no matter how crowded it may be. The building has a low ceiling which would have made the maintenance of comfortable conditions impossible without some means of cooling.

Cooling is furnished by a Freon compressor driven by a two-speed motor which develops 15 hp. at low speed and 20 hp. at high. Air is drawn in from the outside by means of an intake fan and duct and passed over coils which cool it during the summer and warm it during the winter. It is discharged through louvers on either side of the orchestra platform. An exhaust fan draws the smoke, food odors, and vitiated air through a novel circular glass grille in the ceiling of the main dining room. The system has been able to maintain comfortable conditions in the club without recirculating any air even when there has been as many as five hundred people in the main room and a hundred in the cocktail bar. This in spite of the fact that the rooms have low ceilings.

Recently a 20-ton rolling steel roof curtain, set in a steel frame has been installed over the dance floor for use on clear moonlight nights, to give an unusual effect to dancing. The curtain can be opened or closed in 32 sec. When it is closed a battery of concealed lights throws various colors over the ceiling and curtain which are painted in varying shades of blue to simulate the sky.

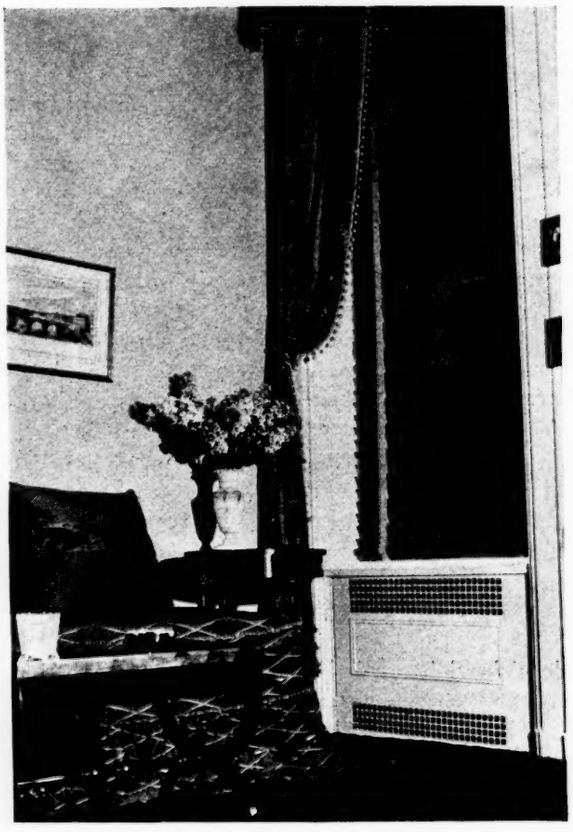
Recessed Radiators Aid in Renting Apartments

NOT long ago one of the older apartment hotels in New York was modernized by the Metropolitan Life Insurance Company, new owner under foreclosure, into a carefully planned apartment dwelling of 38 suites with large store on the ground floor and six offices and shops on the second floor. Weitbeer Plumbing & Heating Co., New York, executed the heating contract, and installed 175 recessed radiators to replace a smaller number of distinctly old fashioned exposed standing radiators most of which were more than a quarter of a century old.

The eight-story and penthouse structure is located at 1 West 30 Street. Following the first "grand opening" in 1887 of the building, recently known as The Wilbraham, it was rated as one of the city's finest residential buildings. Many noted persons, such as Lillian Russell, lived here and applicants for residence who had no social connections usually were denied leases. Following the practice of that time the radiators were enormous masterpieces of iron casting, embellished with scrolls, oak leaves and designs such as struck the foundryman's fancy in those times. Units standing 5 ft. high were not uncommon in hallways and other spots.

As time passed, rental prices declined, residents became less select and by 1934, all tenants except three had vacated due to failure of the management to make necessary repairs and remodel. Obviously, the structure proved a losing venture and the Metropolitan company had to order modernization to protect its investment.

The architect designed six apartments per floor, with a large store on the first floor and six offices on the second floor, thus making 36 dwelling apartments. On the roof is a large penthouse, formerly occupied by maids and used for storage purposes, now redesigned into two apartments, one of which is occupied by the building superintendent, the other rented.



Recessed radiator set in window space aids in renting modernized apartment

While floors were laid bare the heating contractor replaced most of the heating condensate return lines and installed new steam supply branches and returns to many new radiators. Penthouse heating was entirely replaced both as to leads and returns, in addition to the installation of recessed radiators. Most of the apartments now are of one, two, and three rooms, with kitchenettes.

A representative of the renting agents asserts that recessed radiators undoubtedly have assisted in rentals. Attention is called by the agent to the concealed radiators, and prospects are impressed with the neatness, cleanliness, added floor space, and other advantages that characterize this type of radiator.

Gas for Occasional Heating in Auditorium

THE Academy of Medicine, Newark, N. J., has modernized by having Kengetter & Merz, heating contractors, install gas conversion burners in the coal-fired steam boiler that warms the auditorium. This room is 60 ft. x 43 ft., with a 17-ft. ceiling. Coal was formerly used for heating. It was the practice to start the fire about 6 a.m. on the days when meetings were to be held in the auditorium, these usually being twice a week.

Slowness of the warm-up process is said to have failed to heat the room adequately prior to the arrival of students and could be kept warm only by constant janitor care during the few hours during which lectures were in progress.

The improvement has permitted starting the burners at 7 a.m., an hour later than previously, and the room is up to the limit sought by 9 a.m. when students arrive. The additional cost of fuel is said to be counterbalanced by better heating and labor saving.

Multiple Compressors Save Power in Rotogravure Air Conditioning Plant

ATMOSPHERIC needs of a modern rotogravure plant include proper and definite humidity with slight variations, because constant regain of moisture means constant paper stretch and perfect registering of multi-color impressions. The sensitiveness of the carbon tissue to moisture regain, because of its great absorbing qualities, demands definite humidity and dry bulb temperature during the whole year. Variations not to exceed 1¼° on the dry bulb thermometer are desirable, with variations of 1 to 3% in relative humidity considered excessive. Careful analysis indicates the following as the most desirable conditions:

Etching department	**72° D.B.**	**with 50%**	**R.H.**
Photo gallery	**74° D.B.**	**with 50%**	**R.H.**
Retouching department	**75° D.B.**	**with 50%**	**R.H.**
Sensitizing of carbon printing	**72° D.B.**	**with 50%**	**R.H.**
Dark rooms	**74° D.B.**	**with 50%**	**R.H.**
Drying room	**75° D.B.**	**with 50%**	**R.H.**

Saving Power with Multiple Compressors

An example of a year 'round air conditioning system in a rotogravure plant is that of Alco Gravure, Inc., Chicago, designed and installed by Frigidaire Corporation.

Attention was given in the design to the possibility of cutting operating expense while accomplishing the desired results. The refrigeration required was the difference between the total heat of the mixed fresh air and recirculated air, and the total heat at the determined saturation or dewpoint which in this instance equalled the equivalent of 60 tons. Obviously, as the fresh air temperature decreased, so would the total heat of the mixture decrease and thereby decrease the amount of refrigeration necessary to reach saturation. Thus it would be a waste of money to operate large tonnage compressors when possibly the mixing air condition was such as would require only 10 tons of refrigeration. It was therefore decided to install six condensing units of approximately 10-ton capacity each.

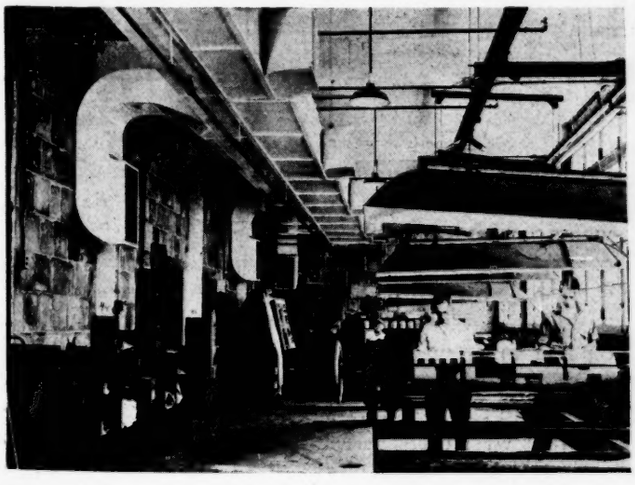
As a further assurance of economy of operation multiple evaporators were installed. Evaporators totaling approximately 60 tons capacity were arranged within the main air conditioning chamber in banks of two deep. Each evaporator was designed for a minimum pressure drop and carefully balanced between sensible and latent capacity.

Air Cycle

It has been mentioned that the mixture of fresh and recirculated air was brought to a saturated state, which because of the conditions to be maintained was determined at approximately 52° dewpoint.

With the air in a state or condition which was controllable regardless of outside conditions or internal heat gain sources, the next step was to determine the desired leaving air temperature and condition under the peak operation. Because of the possibility of only one or two departments being in operation, with the others temporarily inactive, means had to be provided to overcome changes in internal heat gain. In other words, as the heat gain decreased beyond that estimated, heat had to be provided so as to maintain the constant temperatures desired. Therefore booster heating coils were installed in the branch ducts leading to each department, the control of which will be mentioned later.

Humidifying apparatus of both the steam and water spray type was installed in the main coil casing, the spray type intended for summer use and the steam



Two photographs in the plant of Alco Gravure, Inc., the one to the left showing the ductwork in the etching department, while the one to the right shows the ducts in the photograph gallery.

grid type being used during the winter. Reheat coils were also installed in the coil casing to raise the temperature of the air leaving the evaporators to the desired leaving air temperature of 60° or peak conditions in any department.

Air Distribution

Proper distribution of the air with the right amount of diffusion was of as much importance in the design of this system as the arrangement of the temperature regulation. It was found that where conditions were required such as outlined, with no variations throughout the entire conditioned area, a minimum of air movement was necessary. To accomplish this, it was decided to supply air through several diffusion type supply outlets and at an unusually low velocity, returning this air to the ceiling directly behind the supply outlets. This system required 21,000 c.f.m. of conditioned air to be circulated. A slow speed, quiet operating supply fan was selected and was set to discharge the air into the main trunk supply ducts at a velocity not to exceed 1000 f.p.m. which permitted an outlet velocity at the grille of approximately 300 f.p.m.

Humidity and Health

WRITING to the Journal of the Royal Society of Arts, H. F. D. Jacob makes the following interesting remarks on the balance of rate of perspiration with rate of evaporation and absorption in air, as a factor in comfort cooling. He says:

As far back as 1896, in May that year, I installed what I believe to be the first electric ceiling fans in Calcutta. They were put in for a wealthy native whose home we had just fitted up and supplied steam plant for; at that time there was no central electricity supply and only a few installations were in existence in jute mills. A new problem was introduced, as the fan, giving a continuous movement of the air against the old hand-pulled punkah's intermittent breeze, was found to chill some people considerably. This was generally in the early morning when the temperature was lower with more moisture in the air. I myself found it affected me considerably, so I, with others, went into the matter of speed control, and the speed regulator for fans was introduced.

After the electric supply was started in about 1899 or 1900 fans became generally popular and the punkah coolie was practically doomed. A few years later a fan much larger and faster-running than the usual type was introduced and became a great favourite.

I noticed that quite a number of people came home from their offices in the hot weather with bad headaches and a rise of bodily temperature of one to two degrees: a small rise is usual in a tropical country, but without the headaches. I then investigated and found that in nearly every case I examined the person was using these large high-speed fans, and they did not use regulators. It was thought that the hotter the day the faster the air should be blown over the body to cool it. This did not appear to be right to me, so I experimented on myself. I had the same symptoms when I used the fan running at full speed on days when the air temperature in my office was 100° and over—the higher the temperature the worse the headache. On thinking the matter over, the only advantage of the air stream was to evaporate the perspiration rapidly—the rate of flow of this being more or less constant.

If the air flow was more rapid than necessary to evaporate the perspiration, and the temperature was higher than that of the body, it seemed clear that heat units would be added to the body and temperature rise. I therefore tried by cutting down the speed of the fan to equate the flow of air to the speed of perspiration and found that I felt better and could do more work under these conditions.

After this, in any installations I put in I did not use high speed fans, and though at first there was some difficulty in getting clients to see my point of view, when, after trial, they found they felt more comfortable and not so tired at the end of the day there was no more objection, especially as the use of smaller fans at slower speeds considerably decreased the consumption, and therefore the cost, of electric current. When it is known that some of the Government offices have over 1,000 fans installed this becomes an important point.

Of course, during the rains, when humidity and temperature were in the nineties, quite a lot of 'breeze' was necessary to cause any evaporation from the body at all. In my early days in India the railway carriages were cooled by air caught by a scoop outside the carriage, this air being forced through a wet khuskhus tattie. The tattie was in the form of a disc dipping in water which was sucked up by the grass (khuskhus) of which the disc was made. These tatties, two to each carriage, made quite a considerable difference to the temperature of the air in the carriage, especially as the outside sun temperature was in the neighbourhood of 150°-160°. The windows where the tatties were not fixed were covered with venetian shutters. Later, electric fans were used instead of tatties and the result was nothing like so efficient, and whenever I travelled in the hot weather I always hung a wet towel about six inches in front of the fans to get a reasonable result.

$2½ Million for Government Air Conditioning

A HOT summer's work in hot Washington may have been the deciding factor that induced Senate and House Conferees to include in the Second Deficiency Appropriations Bill an item of $2,550,000 to cover the cost of air conditioning the National Capitol, the Senate Office Building, and both the new and old House Office Buildings. In any event they did it, and plans are now in progress for this immense installation.

Engineering work for the installation in the Capitol and the old House Office Building will be done by Charles S. Leopold, 213 South Broad St., Philadelphia. The engineering job on the installation in the Senate Office Building and the new House Office Building has been assigned to George A. Weschler, 732 17 St., NW., Washington. No advertisement has been issued for bids on this job as yet.

Work on another huge Government Building to be completely equipped with air conditioning is all set to go. George A. Fuller and Company submitted the low bid for the new Department of the Interior Building, at a figure of $9,284,000. Other bids on this job, which were opened by the Procurement Division of the Treasury, included a figure of $9,370,000 which was submitted by the Consolidated Engineering Co., Baltimore. Cauldwell-Wingate Co., New York, was the next runner-up with a $9,461,000 bid. These bids will go before the Board of Award of the Public Works Branch for formal examination to determine whether there is sufficient money available out of the allocation made by the PWA for this building. Purchase of the site was paid for out of the allocation of $11,100,000.

Frigidaire Corp., Washington, has been awarded the contract for air conditioning rooms 3128-3130-3132 and 3134 in the Navy Building. The contract price was $4,426.75. A similar contract for air conditioning rooms 1932-1934 and 1934-A in the same building has been awarded to the Automatic Refrigerating Service Co., Washington, for $1,280.

The work of air conditioning the Court House Building at Miami, Fla., will be done by the York Ice Machinery Corp., Philadelphia, under a contract awarded by the Procurement Division of the U. S. Treasury. The contract figure was $6,672. The working time allowed is 45 days.

Additional heating facilities for the Post Office at Philadelphia will be installed under the supervision of the Procurement Division of the Treasury Department. The contract for this job has been awarded to Palmer J. Stephens Co., Kansas City, Mo., at a figure of $14,550.

The Industrial Heating and Engineering Co., Milwaukee, has been awarded the contract to install new boilers, stokers, and equipment at the Jefferson Barracks, Jefferson, Mo. The contract figure was $41,799.

The Rotary Construction Co., Philadelphia, has been awarded the contract for the installation of a boiler house and boiler equipment for the Veterans' Administration Facility, Bronx, N. Y. The contract figure was $23,875.

Kansas City's $5 Million Municipal Auditorium Being Air Conditioned

MECHANICAL equipment for what is probably the largest single refrigerating system ever assembled for air conditioning purposes in the middle west, is now being installed by the York Ice Machinery Corporation in the new Municipal Auditorium at Kansas City.

The air conditioning plant consists essentially of four separate water cooling systems, which are identical in design. The major elements of each system consist of one 4-cylinder 15 in. x 13½ in. Freon compressor, direct connected to a 400-hp. synchronous motor; shell and tube condenser; shell and tube water cooling unit, with auxiliary equipment and pipe mains.

Each of the four systems is designed to cool water at the rate of 750 g.p.m. from a temperature of 48° to 40° or a total of 3,000 g.p.m. of water. This water, at 40°, is circulated by centrifugal pumps to six large air washer units, located at various points.

These air washers are also equipped with heating coils, and the entire system, including ducts, washers and fans, is designed not only to cool and dehumidify the air in summer, but to heat and humidify the air in winter, maintaining it at an even, controlled temperature and humidity best calculated for maximum personal comfort throughout the year. As the building is of the most modern windowless design, this is an important feature, as the system is designed for complete year 'round air conditioning and ventilating service, in a degree that shall be adequate to supply at all times and under all conditions the normal functions of fresh air and ventilation ordinarily obtained from the windows. Automatic bypass control regulates the functioning of all washers. Each of the four systems will develop a refrigerating capacity of 254 tons, providing a total capacity of 1016 tons.

When the installation of this refrigerating and air conditioning equipment is completed and placed in operation, it will condition the air of the main auditorium, which has a seating capacity of 18,000 people and a volume of 5,000,000 cu. ft.; the exhibition hall, which has approximately two and one-half acres of exhibition floor space and will accommodate from 8,000 to 12,000 people. Three general function rooms, each capable of seating 1,000 persons, and a theater, seating about 3,000 people, with main floor and two balconies, will also be air conditioned.

Engineering Gas Conversion Burner Installations

2—Selecting the Burner and Controls

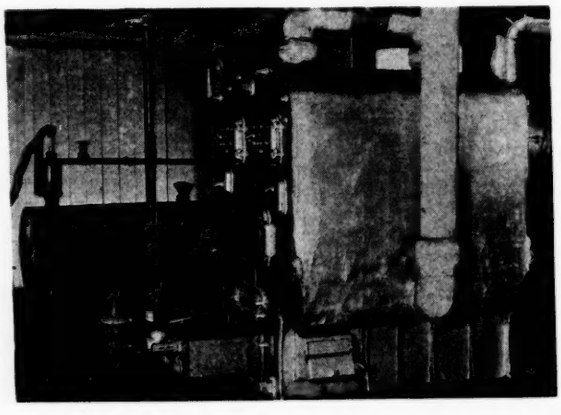
By ALFORD G. CANAR†

MOST important among pre-installation engineering considerations is the selection of the most suitable size and type of burner for the particular job at hand. Two main factors enter into this: Probable gas capacity required and how the heat developed by the combustion of the gas will be applied to the firepot heating surfaces.

As mentioned in the previous article, over 50% of the heating surface on any boiler or furnace is contained within the firepot. This firepot heating surface is also the most effective, because in the firepot there is the greatest differential in temperature between the gases of combustion and the water in the water leg or the air within the casing. Coal boilers and furnaces are designed to utilize effectively the intense convected and radiant heat coming from a bed of incandescent solid fuel.

The best burner to use is the one which will simulate the solid fuel fire to the greatest extent. Since no atmospheric burner has thus far been developed which will give a really good imitation of a solid fuel fire, it becomes necessary to choose a burner which will permit the best possible application of convected and radiant heat.

For any particular boiler or furnace a burner should be used which will permit the highest possible concentration of heat as low down on the firepot walls as possible, preferably just above the grate line, and without favoring one portion of the firepot wall over any other portion. When such a burner application is made the convected heat will be properly applied and the radiant heat will automatically be utilized to a good purpose. Hence, the burner which will concentrate the heat application close to the grate line will work out the best because the hot gases will ultimately take care of the heating surfaces farther up in the firepot and in the upper flue passages anyhow. The higher the proportion of the firepot heating surface in relation to the total heating surface, the more important it becomes to make the best possible selection of type and size of burner to effect the best possible heat application in the firepot.



The burner itself is important to the extent of being able to burn the required gas capacity within its normal rating. A burner should never be overgassed beyond its normal capacity. Burners should be selected, whenever possible, which will readily handle the necessary gas consumption for the job well within their normal capacity. The shorter the flame the lower the hottest part of the flame and the lower the heat concentration, because the hottest part of the flame is well up in the flame and not in the lower portions of the flame. Refractory stacks and refractory or metal burner baffles have some bearing on how the heat is given off by the burner, but as to radiant heat it is questionable how much of it is generated. Refractories probably serve more as deflectors of the flame than as radiating elements, that is, their function is primarily to deflect the flame and gases toward the firepot wall and only secondarily to provide radiant heat. Of course, the hotter these refractory baffles become the more radiant heat they will provide, but at best they will supply only a comparatively small proportion of the total heat given off. Therefore, it is well not to expect too much of these burner baffles. Since burners are usually of the blue flame or nonluminous type not much radiant heat from the flame itself can be expected. Experience has shown that a burner application to the boiler or furnace which will apply the maximum convected heat to the firepot heating surfaces will work out the best, because if the heat is applied correctly from a convected heat standpoint, then the radiant heat recovery will automatically be taken care of.

Proper application of a burner to any firepot resolves itself to a question of the judgment of the engineer. He must guide himself by the dimensions of the firepot and the dimensions of the grate, or rather the clearance between the grate lugs. It is a good policy to specify the largest burner that the grate lug clearance will permit because then the burner flames will be closer to the firepot walls in the vicinity of the grate line and the convected heat application will be better not only because the flame is closer to the firepot wall, but also because the hottest part of the flame will be lower down when the flame is shorter. The engineer should visualize to himself just what will happen

†Space Heating Division, The Peoples Gas Light and Coke Co., Chicago.

when a burner will be installed in a firepot and thus take this into consideration in his selection of a burner.

Another factor which the engineer should consider is at what part of the combustion chamber the gases leave for the upper flue passages. The crownsheet of a boiler is an effective heating surface and a direct application of heat to it should be provided for, especially in round boilers with only side openings leading to the upper flue passages or sectional boilers having openings only at either the front or rear end of firepot.

Round boilers having center openings through the crownsheet, cast iron furnaces, and sectional boilers which have openings between all the sections leading to the upper flue passages require a somewhat different burner application because the natural gas travel is toward what corresponds to the solid crownsheet of the other type. Sectional boilers of the smokeless type which have hanging water legs in the rear of the firepot should be equipped with a burner which is short in depth but covers the width of the firepot so that the side walls of firepots are well contacted by the gases as they travel toward the rear and are then deflected downward by the hanging water legs. Multiple jet burners of either the horizontal or vertical type are suitable for such boilers. Steel firebox boilers need a good application of heat not only to the side walls of firepot but also to the crownsheet of the firebox, and a burner should be used which will have some open flame to apply directly to the crownsheet.

Sectional boilers of the smokeless type which have a double grate, that is, a water grate at some distance above the regular grate, should be equipped with a burner short in depth and of a width to cover the width of the firepot and installed at the front of the firepot and at the level of the regular grate, so that the flame and gases pass upward through the water grate at the front, to contact the crownsheet, after which they travel to the rear and down through the rear portion of the water grate and under the hanging water leg in rear of lower firepot and thence upward through the upper flue passages. Multiple jet burners or any open flame burner of the vertical type are suitable burners for boilers of this nature.

Steel boilers of the smokeless type having a water grate of water tubes at some distance above the regular grate require a burner application similar to that of sectional boilers of the smokeless type.

Sectional boilers of the low water line type usually have short and wide firepots and the gas travel from the firepot to the upper flue passages is between all the sections. Whether the openings to the upper flue passages occur either at the front or rear, a burner should be used which will well cover the area of the firepot if the burner is of the Bunsen type. Sometimes it is possible to install a burner in this type of boiler through the side of the ashpit and when this can readily be done a burner of the horizontal multiple jet type or gun type results in a good application.

In most any locality the general run of boilers will be found to be the round and the rectangular sectional type and the furnaces will be the round cast iron circular radiator types with an appreciable number of round steel rear radiator furnaces. However, some boilers of a design radically different will also be encountered, but the same principles of burner selection discussed above should be applied.

The whole problem of proper burner selection hinges on the judgment of the heating engineer based on his past experience in observing a large number of a variety of installations. After he has decided what the approximate required gas consumption must be, he should carefully examine the boiler or furnace at hand, study the design of the firepot and combustion chamber and the gas travel from the combustion chamber to the upper flue passages. Then he is in a position to make a tentative choice of burner and he should have a variety of types and sizes of burners available so as to meet the variety of boiler and furnace design he may encounter. He should choose a burner which will have a maximum gas capacity well above the approximate required gas consumption which he estimates

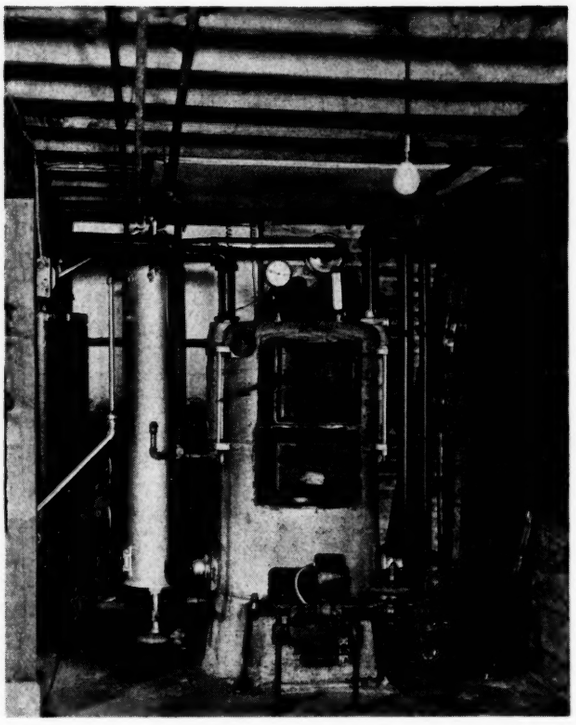
It is a good policy, whenever possible, to choose a burner which will have a maximum gas capacity at least 20% greater than the estimated requirements, because certain conditions may exist on a job which are not apparent before the installation of the burner and which may make it imperative to use a greater gas consumption than was estimated. This illustrates the value of having a factor of safety available as regards gas capacity of a burner. A boiler may have more direct radiator surface connected to it than it is rated for and such a boiler will require a gas consumption on the burner which may appreciably exceed that which was calculated. The calculated required gas consumption is only an approximation and may or may not be a close approximation; hence it is always advisable to have a factor of safety available on the burner. After the installation of the burner a heating test should be made to determine the correct gas input required to handle the job and if the burner does not have sufficient capacity to meet the necessary gas requirement it is obvious that a difficulty is encountered which may entail the expense of replacing the burner with one of sufficient capacity.

Power Burners

The above discussion on burner selection refers primarily to atmospheric burners. However, there are good power burners now available and these should be seriously considered for house heating boilers and furnaces. The same principles of burner selection should be applied to the selection of type and size of power burner so that the best possible application of the generated heat to the firepot heating surfaces will result. Some power burners within themselves generate considerable radiant heat and others depend upon a certain refractory setup in the firepot for radiant heat, the design of the refractory setup depending largely upon the design of the boiler. No one type of burner, whether of atmospheric or power kind, has a universal application, hence the judgment of the engineer is the important factor as regards burner selection.

It sometimes happens that a round boiler is encountered which has an exceptionally low firepot. Usually round boilers have firepots which are as deep from crownsheet to grate line as they measure in diameter

Some old obsolete round boilers have very shallow firepots and it would be impossible for any atmospheric burner to burn the required amount of gas consumption, because the number of cubic feet of combustion space would not permit it. The general run of atmospheric burners will burn about 80,000 B.t.u. per sq. ft. of grate in a normal boiler or about 35,000 B.t.u. per cu. ft. of combustion space. But with a shallow firepot it is not possible to burn 80,000 B.t.u. per sq. ft. of grate because the vertical combustion space above this square foot of grate is not there in sufficient quantity.



The solution of this problem is to specify a power burner, since a good power burner will permit the burning of more than double the amount of gas per square foot of grate and likewise more than double per cubic foot of combustion space as compared with atmospheric burners.

Controls

Selection of a burner depends not only on the best application to a firepot but also somewhat on the control desired. The engineer may want a throttling type of burner for a particular job or he may want a snap-action type.

Whether or not a burner has secondary air shutters which close when the burner shuts off also has some influence on burner selection. If the air shutters remain open while the burner is shut off considerably more air is drawn through the boiler or furnace by the draft on the chimney than when the shutters are closed. This means a greater standby loss. This is not as serious a consideration with a hot water or warm air job because circulation of the heating medium continues for some time after the burner shuts off. But with a steam job open air shutters will reduce 3 lb. of steam pressure at the time the burner shuts off to zero within a matter of one or two minutes and the circulation of the heating medium is very quickly stopped. Burners of the fixed open air shutter type have been arranged so that the shutters will close when the burner shuts off. It has been found that from five to six times as much time elapses before 3 lb. of steam pressure are reduced to zero than occurs when the air shutter is left open.

The open air shutter has its greatest effect on a steam job, less with warm air, and least with a hot water job. There is nothing especially serious about this factor but it does play its little role in the drama of heating with conversion burners.

Selection of a thermostat must also be given some consideration. There is a variety of thermostats available and it is well to make a choice of the one which experience has shown will work out the best for the given conditions.

Any customer who has been accustomed to a clock type thermostat either on his oil burner or with his coal firing should not be given a plain thermostat without the clock feature, because he is used to the automatic shutoff to a reduced temperature at night, and the automatic startup of the burner in the morning. He will not be satisfied without the clock feature and you can rarely make him like the plain thermostat.

We now have thermostats available which operate on fractions of a degree or give frequent cycling, such as every 20 or 30 min. These thermostats have advantages insofar as hot water or warm air jobs are concerned since they create a condition of shorter on and shorter off periods, hence the circulation of the heating medium is maintained to a much greater degree than with the old conventional type of thermostat. However, with a steam job this frequent cycling is a disadvantage because we can not expect such a rapid response as with hot water or warm air.

It is necessary to bring the boiler water to a boil, which may require 10 or 15 min., depending on how long the preceding off period was and after that a certain amount of steam pressure must be developed to push the air out of the piping and radiators which all takes additional time, and the result is by the time the short cycle is over you have not delivered any heat to the radiators and thus some gas has been burned which did nothing of any value and, consequently, this gas has been wasted. Therefore, it is advisable to avoid the frequent cycling thermostat for a steam job except if this cycling can be adjusted to cycle not more frequently than hourly, because the short cycling action is not conducive to economy of operation.

Next month the author will discuss the estimating of gas consumption and methods of sizing flue pipes.

STATE LAWS ON VENTILATION

Amount of Ventilation Air Required for Schools and General Industrial Buildings as Fixed by State Laws in the Several States

State	Ventilation Air* Cu. Ft. per Hr. per Person (C_v)	Remarks
	Public School Buildings *(Classrooms Unless Otherwise Noted)*	
Idaho	1800	Use of direct radiators in classrooms not permissible. No mention of recirculation.
Indiana	1800	Specifies 1800 cu. ft. of *fresh* air, but notes that used air may be reheated if state Department of Health approves system of reheating and washing.
Louisiana	1800	Both state and local officers approve plans. No mention of recirculation.
Maine	1800	Specific mention of separate foul air ducts to remove air at the rate supplied to each room.
Massachusetts	1800	Direct radiators may supply heat to 50° at zero outside. Specifically calls for *fresh* air and for definite removal of like amount. Partial recirculation permitted in rooms where there are washers and automatic temperature control, subject to approval in each case. Fume exhaust required in chemical laboratories. Assembly halls and gymnasiums—not less than 2½ c.f.m. per sq. ft. of floor area; 1½ cu. ft. per sq. ft. of floor area in gymnasiums, locker rooms, and emergency rooms.
Michigan		No direct statement about quantity, but recirculation for economy permitted. Air filters and washers may be used.
Minnesota	1800	Also no system approved which does not renew the air at least four times per hour. Recirculation up to 75% permitted while building is in use if proper air washer or filter is installed. When not in use, recirculation advised regardless of presence of filter or washer.
Montana	1250	Also not less than 250 cu. ft. of classroom volume per student. Specifies *fresh* air. If not more than 200 cu. ft. of space per student, air must be changed not less than five times per hour.
New Jersey	1800	Air is *fresh* air, by inference.
New York	1800	Specifies *pure* air. Also mentions not less than 35% R. H. Recirculating devices not considered as meeting the requirements of law.
North Dakota	1800	Exhaust facilities also required.
Ohio		Classrooms, assembly rooms, toilets, not less than six changes per hour. Other spaces, three changes.
Oklahoma	1800	Mentions *fresh* air, and specifies the quantity in cold weather.
South Dakota	1800	When temperature difference between indoor and outdoor is not less than 30°.
Texas	1800	Classrooms and study halls to be supplied with *fresh* warm air; also adequate exhausts.
Utah	1800	Classrooms, 1800 cu. ft.; assembly rooms, 1500 cu. ft.
Wisconsin	2 c.f.m. per sq. ft. of floor area	50% recirculation permitted during occupancy with screens at inlets; 75% when dust eliminator is operated in air supply circuits; 100% when building is unoccupied. Corridors and halls not less than ½ c.f.m. per sq. ft. floor area. Air to be properly humidified.
	Industrial Buildings *(General)*	
Illinois	1500 to 1800	Health, Safety and Comfort Law requires that factories or workshops having between 500 and 2000 cu. ft. of air per person shall supply *fresh* air at rate of 1500 cu. ft. per hr. per person in weather when temperature is too low to permit opening of windows, provided that such factories shall have outside door and window openings equal to not less than one-eighth the floor area. If less than this amount, then 1800 cu. ft. of fresh air per person.
Ohio	60 cu. ft. per hr. per 2 sq. ft. of floor area	Where cubage per occupant is less than 400 cu. ft. or where natural ventilation is impossible.
Wisconsin	60 cu. ft. per hr. per sq. ft. of floor area, and not less than 1800 cu. ft. per hr. per occupant	Specified for certain limited classes of industrial buildings and to be in addition to any air necessary to make up for process contamination. Code under direction of Industrial Commission.

*Recirculation assumed not permissible unless noted.

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PROPOSED NEW YORK CITY VENTILATION LAWS

Amount of Ventilation Air Required for Various Types of Occupied Rooms As Determined by Rules in Proposed Building Code for New York, 1932

1. Where excessive heat may be created to the detriment of the occupants, or where steam, gases, vapor, dust or other impurities in the air, which may be injurious to health, may be generated in the course of commercial activities, rooms shall be ventilated in such manner as to render them harmless to any person therein.

2. Spaces below grade without windows, and designed for human occupancy shall have a mechanical means of ventilation of at least 50 cu. ft. per person per min., and at least four changes of air per hour, with provision for a corresponding air inflow from an uncontaminated source.

3. Every bathroom, toilet room or other room containing one or more water closets or urinals, hereafter placed in any structure, shall be ventilated in at least one of the following ways:

(a) By a window, opening to a street, yard or court of lawful dimension and having a clear ventilation area of at least 5% of the floor area, but at least 3 sq. ft. and a width of at least 1 ft.

(b) By a window of the size specified in 3*(a)* opening on a vent shaft which extends to and through the roof, or into a court of lawful dimensions and which has a cross-sectional area of at least 1/5 of a sq. ft. for every foot of height, but at least 9 sq. ft. and, unless open to the outer air at the top, a net area of louver openings in the skylight equal to the maximum required shaft area.

(c) By an individual vent flue or duct extending independently of any other flue or duct to and above the roof and having a cross-sectional area of at least 1 sq. ft. for one or two water closets or urinal fixtures and 1/3 of a sq. ft. additional for each additional water closet or urinal fixture.

(d) By a skylight in the ceiling, having a glazed surface of at least 3 sq. ft. and arranged so as to provide ventilating openings of at least 1½ sq. ft. to the outer air above the roof of the structure or into a court or yard of lawful dimensions, for one or two water closets or urinal fixtures and 1 sq. ft. additional for each additional water closet or urinal fixture.

(e) By some approved system of mechanical exhaust ventilation of sufficient capacity to exhaust at least 40 cu. ft. of air per min. per water closet and per urinal for public toilet rooms, and at least 25 cu. ft. per min. for private interior bathroom.

(f) Interior bathrooms and water closet compartments shall have openings from adjacent rooms or corridors ample to provide a sufficient inflow of air to make exhaust ventilation effective.

(g) The use of pipe shafts as ventilating shafts is forbidden and such pipe shafts shall be floored over solidly at every third floor. Separate exhaust flues shall be provided for every 250 ft. of height of structures, and these flues shall be of approved construction.

4. Inside locker rooms and rooms of similar usage shall be provided with exhaust ventilation giving at least two changes of air per hour.

5. Refrigerating plants shall be ventilated in accordance with the rules and regulations of the Fire Department.

6. Inside spaces where cooking of any kind is done shall have a mechanical exhaust ventilation of at least 150 cu. ft. per min. The exhaust shall be collected in a sheet metal flue connected to an independent common flue in a fireproof shaft. Such flues shall be of No. 16, United States gage sheet steel, or terra cotta, and shall be connected to a separate fan.

7. Spaces above grade, with or without windows, designed for human occupancy only, shall have ventilation either from windows or from mechanical means, or from both, in accordance with the following index and requirements:

Cubic contents per person plus 10 times floor area per person plus 100 times the entire window frame opening per person equals Index.

For Rooms with Windows

(a) If the Index is less than 300 there shall be supplied an amount of fresh air equal to 2½ cu. ft. per min. per sq. ft. of floor area, and an air exhaust of 2 cu. ft. per min. per sq. ft. of floor area.

(b) If the Index is between 300 and 520 there shall be supplied an amount of fresh air equal to 2 cu. ft. per min. per sq. ft. of floor area, and an air exhaust of 1½ cu. ft. per min. per sq. ft. of floor area.

(c) If the Index is between 520 and 850 there shall be supplied an amount of fresh air equal to 1½ cu. ft. per min. per sq. ft. of floor area and an air exhaust of 1¼ cu. ft. per min. per sq. ft. of floor area.

(d) If the Index is between 850 and 1650 there shall be required an air exhaust only of 1 cu. ft. per min. per sq. ft. of floor area.

(e) If the Index is above 1650 no ventilation is required.

For Rooms without Windows

(a) If the Index is below 850 the requirements shall be the same as for rooms with windows.

(b) If the Index is between 850 and 1650 there shall be required an air supply of 1 cu. ft. per min. per sq. ft. of floor area and an air exhaust of 1 cu. ft. per min. per sq. ft. of floor area.

(c) If the Index is over 1650 there shall be required an air supply of 1/3 cu. ft. per min. per sq. ft. of floor area and an air exhaust of 1/3 cu. ft. per min. per sq. ft. of floor area.

(d) Interior partitions shall have transoms or equivalent openings, and when partitions occur 30 ft. or more away from a window or similar opening the room so formed shall have ventilation based upon the Index without windows.

8. Spaces below grade with or without windows, designed for live storage of four or more gasoline propelled cars operated within the storage space under their own power, shall have at least four changes of air exhaust per hour by mechanical means, with provision for a corresponding air inflow from an uncontaminated source. Two changes of the four shall be taken from near the floor.

Spaces above grade with or without windows, designed for the same purpose, shall have openings near the floor on all outside and court walls. These openings shall be at least 6 in. x 4 in. and within 6 in. above the floor, and shall be spaced between wall columns and at least every 16 ft. where columns do not occur. Such spaces shall also be subject to the requirements of (1).

Pits below floor levels shall have mechanical exhaust ventilation taken from near the bottom of the pits.

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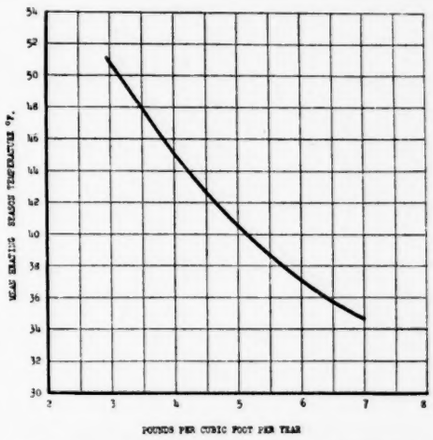
Steam Consumption in Office Buildings

A RECENT report of the Edison Electric Institute indicates that steam for heating of office buildings varies almost in direct proportion to the mean heating season temperature and averages about 6 lb. of steam per cu. ft. of building per year in localities where the mean heating season temperature is 37°, and about 3½ lb. per cu. ft. per year where the heating season temperature averages 48°.† According to the report the average office building schedule is 70° per 12 hr. five days a week and 6 hr. on Saturdays, and 55° for the remaining hours.

Where the building supplies its own heating, either by exhaust or by live steam, the average use will be from 4.5 to 6 lb. per year per cu. ft. in localities where the average outside temperature over the heating season is 42° depending on shape, exposed area, glass area, and general exposure. However, where steam service is purchased and the cost is subject to more direct scrutiny by the management, the steam use is nearer 3.5 to 4 lb. per cu. ft.



Building heating steam plotted against mean heating season temperature for typical office building from report of the Edison Electric Institute

For localities with this same 42° mean temperature a comparison of the heating and power cycles in buildings having modern isolated plants with efficient generating units and all equipment motor driven, shows that the exhaust steam will supply about 65% of the heating requirements, the remaining 35% being live makeup at night and on very cold days when the exhaust is insufficient. Naturally, during the summer and on mild winter days there is an excess of exhaust steam. The exhaust wasted annually generally amounts to from 40% to 50% of the total exhaust available.

Old buildings with inefficient generating units and steam pumps may have sufficient exhaust steam to supply all the heating, states the report. This, however, results in a correspondingly greater loss of exhaust during the summer and the mild days of the heating season.

The steam required for hot water heating ranges from 0.5 to 1 lb. per cu. ft., with the general run of high class buildings averaging 0.9 lb. Where an isolated plant is installed this requirement will be supplied by exhaust steam.

Ordinarily there are no steam uses other than building and hot water heating. Where they do occur they will be for special purposes, such as restaurants, stores and air conditioning, and must be determined individually. The accompanying table summarizes some of these scattered data included in the report, giving figures taken from a number of typical office buildings in various localities.

Location	Steam, Lb. per Cu. Ft. per Year		
	Heating	Hot Water	Process
Philadelphia, 19 Class One buildings[1]	5.28	0.98	1.38
Philadelphia, 10 Class Two buildings[2]	5.12	0.75	0.56
Philadelphia, 12 Class Three buildings[3]	4.25	0.39	—
Chicago, 11 buildings	4.25	1.01	5.14
Michigan, 3 buildings	4.45	—	—
Georgia, 3 buildings	3.25	—	—
Boston, 7 buildings	4.47	—	—

[1]Generally new, in active commercial districts.
[2]Generally old, in less active districts.
[3]Special purpose buildings.

†The report is entitled "Steam and Electrical Requirements of Office Buildings," and is Publication No. C2 of the Edison Electric Institute, 420 Lexington Ave., New York. The price is 30 cents to members of the Institute and 75 cents to non-members in the U. S.

Soil Warming System Hastens Crops

A large-scale soil-warming system has been installed at an agricultural college just outside London. This was revealed by W. L. Boon at the annual meeting of the British Institution of Gas Engineers, just held in London.

Experiments carried out have revealed that the growth of market garden produce and flowers can be advanced from four to six weeks by this method. According to Mr. Boon, the system is simple and consists of pipes laid about 16 in. deep, equally spaced and vented to give a uniform ground temperature through the medium of hot water circulation. The pipe system is serviced by a coke-fired boiler burning gas works' coke, automatically controlled by a thermostat, set in accordance with the ground temperature required.

"Ground warmed in this way," declared Mr. Boon, "will produce its crops at a high market value and, as it appears that the cost of warming the soil is more reasonable than glasshouse heating, the promise from experimental plots is sufficient to view the prospect of the development with optimism."

GETTING DOWN TO FUNDAMENTALS

7—Conclusion Regarding the Determination of Amount of Ventilation Air Necessary

Foreword

IN previous articles in this series the nature and direction of flow of the heat quantities on which the usual estimate is made were described. They are (a) transmitted heat, (b) heat from filtration air, and (c) heat from ventilation air. These quantities can be expressed mathematically in the following equations:

$$\text{Transmitted Heat} = H = AU\ (t_i - t_o) \quad (1)$$

$$\text{Heat from Filtration Air} = F = \frac{C(t_i - t_o)}{55} \quad (2)$$

$$\text{Heat from Ventilation Air} = V = \frac{C_v(t_i - t_o)}{55} \quad (3)$$

In these equations: H, F, and V are all in B.t.u. per hour:

A = Area, sq. ft. of surface through which heat passes
U = The transmission coefficient, air to air
C = Volume of filtration air flowing, cu. ft. per hr.
C_v = Volume of ventilation air flowing, cu. ft. per hr.
t_i = Temperature of indoor air, °F.
t_o = Temperature of outdoor air, °F.
1/55 = 0.018 = heat to raise 1 cu. ft. of air at 70° through 1°

Tables were presented indicating present ideas as to what should be used for t_i and t_o under both summer and winter conditions. Then methods of finding values for *C* in equation (2) were described, with tables.

The three last preceding articles have dealt with the complicated question of determining the amount of ventilation air, C_v, for use in equation (3). Values as usually published were presented and found to lack specificity. Values as fixed by legal enactments were tabulated and shown to be fairly specific in some cases and exceedingly general in others.

Part 6, last month, dealt with a consideration of the fundamentals as a possible source of more specific information. It was shown that for human ventilation problems, ventilation air is used to carry away from the body (a) breathed air, (b) heat, (c) moisture, (d) odorous substances, and (e) bacteria. After discussing attempts to formulate rules based on breathed air, it was concluded that this is not the critical factor. Heat and moisture quantities were discussed and it was noted that while the quantities of heat and moisture produced are known fairly well, this fundamental knowledge does not make it possible to formulate any working rules directly because the removal of this heat can be accomplished in so many ways. Heat and moisture quantities *may* be the critical factors in fixing the amounts of ventilation air in some cases, however. In case 1, that of a school equipped for winter operation, it was concluded that these quantities may be the critical ones. We now continue the discussion by presenting additional cases.

Case 2—A residence, equipped for winter operation. No humidification or dehumidification. Direct radiators.

Suppose there is no ventilation air deliberately introduced. Again the tendency would be for temperature and moisture of the air inside the building to rise. To prevent it we have the filtration air and the heat leaving through the building materials just as in the case of the school building. In the residence though, with a very low density of population and therefore with but little moisture added to the air by the occupants, it is extremely unlikely that heat and moisture from humans is a critical factor in fixing the amount of ventilation air at most times. In most cases the filtration air is ample to do the human ventilation job so far as human heat and moisture are concerned.

Case 3—A theater equipped for heating and with a dehumidifier.

First take the case of winter operation, with no ventilation air. The case is like that of the school building and the tendency will be for both the temperature and moisture content of the air to rise. To combat this rise, we have available the filtration air (usually slight in practice in such buildings), the heat passing through the building materials, a dehumidifier which can be operated in winter if desired, and a supply of cool air from outside.

With all these means available it is evident that a considerable amount of both heat and moisture can be removed from the inside air. The whole operating question becomes one of making the best use possible of the means available. Since the amount of filtration air is small and not controllable and since the amount of heat passing through the building materials is also beyond operating control, the practical question becomes whether to use the dehumidifier and artificial cooling or to use the cool air available from the outside. Economy invariably dictates the use of the free outside air so far as possible and the artificial cooling as little as possible. In practice this usually means that in winter operation artificial cooling does not need to be used at all for the cool outside air can be circulated in sufficient quantity to do the required cooling.

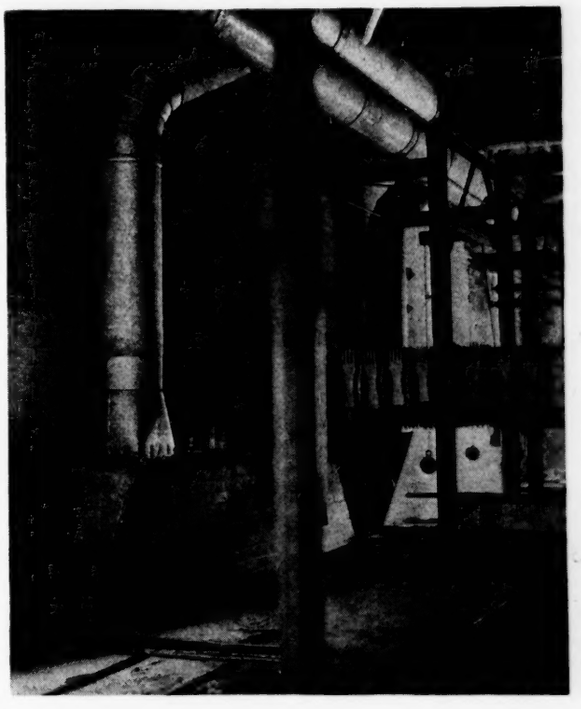
In the case of peak summer operation with no ventilation air we again get the tendency of the temperature and moisture content of the inside air to build up. To check this we now have available no help from the filtration air, none from the heat flowing through the building materials, and no supply of cool air from

outside. The only place in the system where heat can be removed is at the dehumidifier. If both sensible heat and moisture can be removed from the air by this equipment as fast as added evidently it can be just as well removed from the air already in the building as from any additional air brought in. What happens in such a case is not that heat is not removed the same as when ventilation air is used, but that the body heat and moisture are carried away from the building by a circulating medium other than the ventilation air. In the most popular type of installation the medium is the condenser cooling water. In such a case, far from being critical in fixing an amount of ventilation air, considerations of human heat and moisture alone would eliminate the problem entirely by substituting cooling water for ventilation air as the medium to be circulated.

There is another summer theater case of interest. This is the one where there is either no dehumidifier, or else one that is capable of removing only a part of the heat and moisture added to the inside air by the occupants. This is because it lacks capacity either by intent or by inadvertence. In such installations as good use as possible has to be made of the cooling capacity and means available. Such theaters usually use large quantities of outside air and circulate it rapidly through the building and over the occupants to produce as much air movement as possible and thus to promote evaporative cooling of the skin. In such installations heat and moisture considerations are of importance in fixing the amount of ventilation air to be circulated. They are probably wholly the critical considerations and as much air is circulated as space and cost of the necessary handling equipment will permit. It is notable that in these installations air is introduced and distributed over the occupants in a different fashion than is done where smaller air quantities are used for ventilation and cooling.

These three cases present in principle most of the situations encountered in human ventilation work. From them important conclusions can be drawn.

One is that where there is ample capacity of cooling equipment to remove body heat and moisture from a recirculating body of air as fast as it is added to this same mass of air, there is no necessity to use any ventilation air whatever in order to extract this heat and moisture. The cooling medium takes the place of the ventilation air completely if desired. Therefore, in such installations, human heat and moisture are in no way critical in fixing ventilation air quantities. The soundness of this conclusion does not, apparently, seem to be generally understood by many engineers.



Ventilation problems where manufacturing processes are concerned must be approached individually

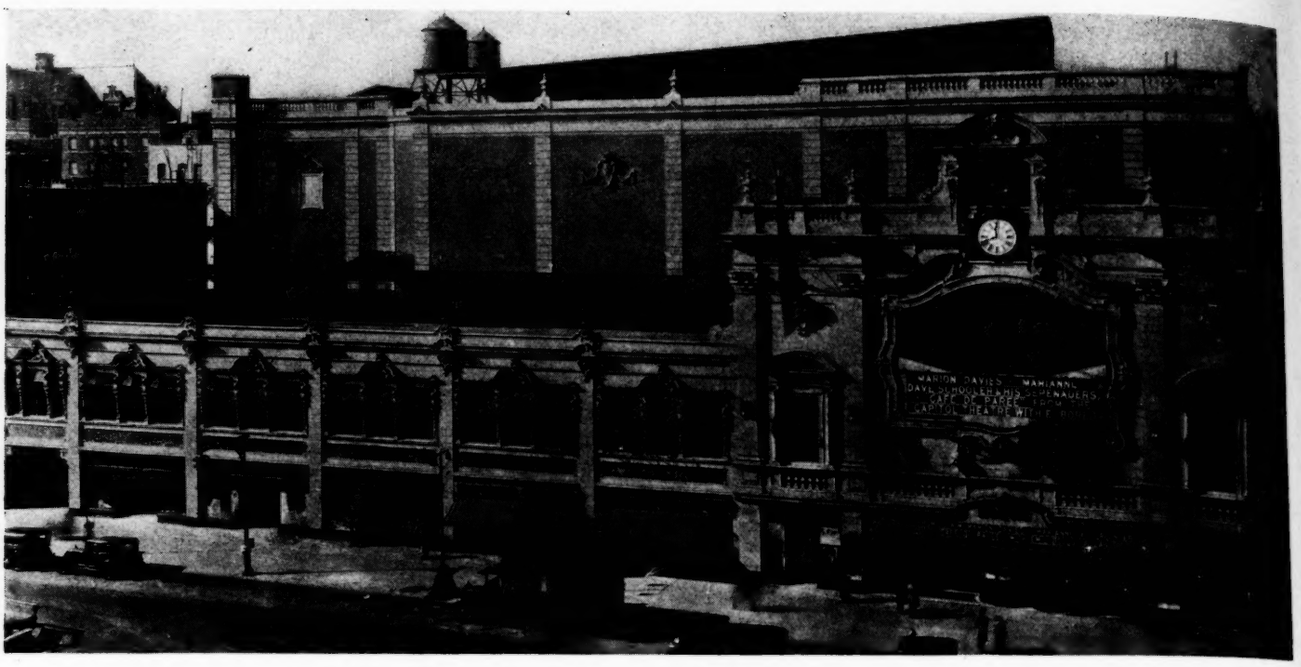
A second conclusion is that in those installations where there is a dense human load and consequently a considerable amount of heat and moisture to be removed from their bodies, the human heat and moisture quantities may become critical in fixing the amount of ventilation air required at some time during the year. If there is ample artificial cooling capacity, as noted heretofore, then no ventilation air is necessary.

At the other extreme are those installations where there is no means of heat and moisture removal at all except the ventilation air itself. This case may occur in theaters during summer operation, and heat and moisture quantities call for flooding the building with just as much ventilation air as can be passed through. Intermediate between these extreme cases lie all kinds of combinations. The more nearly a particular case approaches the one where ventilation air is the sole cooling means, the more critical become the human heat and moisture quantities in fixing the ventilation air quantity necessary.

In winter operation where heat transmission through the building materials and the heat carried away by filtration air assist the ventilation air in carrying away heat from the bodies of the occupants and getting it outside the system, we approach the case where there is ample cooling capacity other than the ventilation air itself and heat and moisture quantities get to be less critical.

It is concludable that in winter operation, especially during the winter peak load, the heat and moisture from the humans in even a densely crowded building do not fix the ventilation air quantities required. If they did there would be no necessity for applying artificial heat or moisture at such times. During summer operation is when the human heat and moisture quantities do become critical. Therefore, the general conclusion is that heat and moisture quantities from humans in crowded buildings are critical in summer operation, and then only when capacity for artificial cooling and moisture removal are inadequate to accomplish the purpose; at the time of winter peak operation they are critical only in the most exceptional cases.

The case of the residence illustrates the situation encountered in all types of buildings where occupancy is sparse. Here again the general rule applies that if there is adequate capacity for heat and moisture removal by means other than the ventilation air, there is no necessity for its use for this purpose. In winter operation the filtration air and the heat transmitted through the build-



Theaters have received more study than any other type building in connection with establishing ventilation rules regarding odors

ing materials carry off both heat and moisture quantities greatly in excess of those generated by the occupants. It is well known that both heat and moisture above the quantities found existing in such buildings are desirable during the winter season and it is common practice to add them. Also it is becoming increasingly a matter of common practice to make no allowance for ventilation air over and above that which circulates involuntarily by filtration. Consideration of the fundamentals indicates that this practice is the correct one. In summer operation, if there is no means of heat and moisture removal except that due to the ventilation air itself then large quantities of ventilation air would be indicated. This conclusion is borne out by experience with methods of summer cooling like the use of attic fans where it is found that large quantities of ventilation air must be circulated to accomplish effective cooling.

This discussion points toward the general conclusion that if heat and moisture to be removed from humans are the only considerations, these quantities are critical in fixing ventilation air quantities in so-called "comfort" installations only in summer, and then only when there is either no means of removing heat and moisture from the air artificially or when such means are lacking in capacity and ventilation air must be used as the cooling agent either alone or to supplement the partial cooling capacity installed.

Odors or Odorous Substances

We can now pass to the matter of odors, or odorous substances, which has been listed as item (d) in our list of what is given up to the air which passes over the bodies of humans in our every-day methods of living. As heretofore, we will examine the fundamentals so far as possible to attempt to learn what effects these substances have in fixing values of C_v, the amount of ventilation air necessary.

At once we come face to face with difficulties. The most distressing is that so extremely little of a tangible nature is really known about odors or odorous substances, how to measure either their nature or intensity, or how best to get rid of them. We do recognize odors from humans as a distinct problem practically always present in human ventilation applications.

Numerous physiologists and psychologists have delved into the subject of odors in general. Their studies have shown that it seems possible to classify odors roughly. Moreover since certain odors are definitely known to be associated with certain substances it seems logical to conclude that the odors arise from these substances. Many of them are gases. A rough classification of odors and some light on their chemical nature is about all of a practical nature that is available to engineers as the result of the attempts of these groups of scientists to get at the fundamentals.

Knowledge of these facts has led to attempts to set up measuring scales for determining both the nature and the intensity of odors. All these, however, have the weakness that they have to depend on comparative standards which involve comparing unknown odors with odors of known concentrations and natures, and the human nose has to be the comparing instrument. It is unsatisfactory as a standard, for individual noses vary and also there is the difficulty of odor saturation —a failing which is inherent in human noses.

As a result of these difficulties attempts to set up odor determination techniques and scales of practical value have not made much headway. We still have to resort to trial and error experimentation to produce useful answers to the questions arising in connection with odors in human ventilation.

Fortunately a considerable amount of field work—

most of it unsystematic—has been done by practicing engineers in the course of their work. There are countless installations so arranged that the proportions of recirculated and ventilation air can be varied at will to use large or small amounts of outside air as desired. Study of the operation of some of these plants has gradually built up a rule of practice which sets the ratio of recirculated to outside air at two to one. It states in effect that for every 3 cu. ft. of air handled, two may be recirculated and one brought in from a source where it has not been previously contaminated by human odors. Supposedly, therefore, this mixture of two parts odor-contaminated air with one part of uncontaminated solves the human odor problem to an extent which permits practical usefulness. Since 30 cu. ft. per person per hour are often handled in these installations, the rule is sometimes stated in terms of "10 cu. ft. per person per minute of outside air will take care of the human odor problem."

Obviously this is empirical and like many such rules it probably states the average. Theaters perhaps received more study than any other type of building in connection with establishing the rule. Strictly, it is possible that the rule should be applied only to theaters. However, it is coming into fairly common use and in the absence of any immediate hope of setting up anything any more fundamental it is useful for general applications.

Practice is not uniform on this point. There are theater installations where as little as one-fourth outside air is used instead of the one-third that the foregoing rule would require. Also some operators adjust dampers to admit less than the one-third which the rule calls for. It should be noted that if one-third is provided for, smaller quantities can be admitted readily by making suitable operating adjustments.

Suppose therefore that we admit that the quantity of ventilation air necessary to solve the odor problem in a practical fashion lies arousd 10 cu. ft. of outside air per person per minute, how does this compare with the quantity as fixed by consideration of the amounts necessary for breathing, and with the amounts dictated by human heat and moisture quantities?

It is apparent that this quantity is far greater than any we were able to justify by considering the fundamentals as related to quantities necessary for breathing. Also it is greater than that required by consideration of human heat and moisture except under extreme conditions. Evidently, then, we can conclude that if an amount of air necessary to eliminate human odors is passed through a building this air will be more than sufficient in quantity to accomplish any other demands upon the ventilation air.

Since we started by stating as a fundamental rule that no more outside air should be deliberately circulated into and out of a building than necessary to accomplish the objective sought, we can now conclude that this minimum quantity is in the neighborhood of 10 cu. ft. per person per minute, and that the odor elimination consideration is what fixes it.

It still remains to give consideration to item (e) on our list, viz: bacteria and dust.

Dust may be removed from the air with equal facility regardless of its source—whether recirculated or from outside. Consequently dust or dirt particles arising from humans or their clothing should have little or no effect on the determination of the amount of ventilation air necessary.

Bacteria given off to the air by humans can be removed by filtering processes to some extent and also to some extent by washing. Much the same is true of bacterial removal when done in this way as was just noted concerning dust. There are undoubtedly cases where bacteria given up by humans to the passing air stream are a matter of serious concern. These cases are, however, not encountered in the course of usual operation and are omitted as a design consideration except insofar as equipment dictated by other reasons assists in their solution. In hospital buildings considerations having to do with bacteria may greatly affect methods of air distribution to be used and, in special cases, may actually dictate air quantities, but in general they may be dismissed as having little effect in fixing human ventilation air quantities.

A General Conclusion

In view of all this what can be concluded as to the amount of ventilation air really necessary in human ventilation problems?

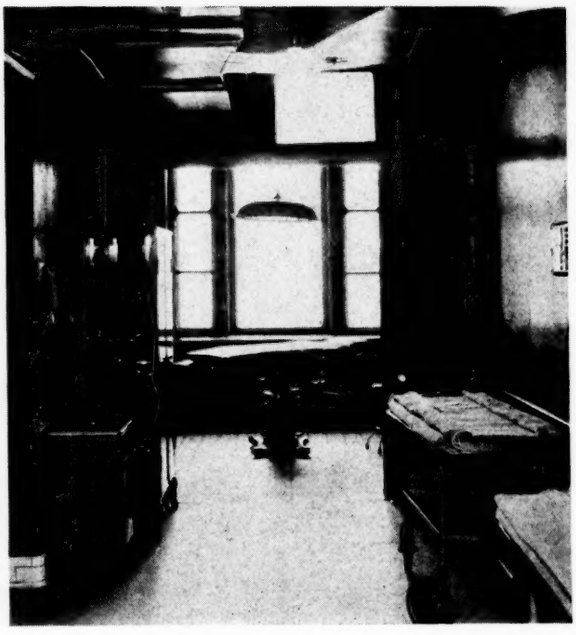
We have seen that air for breathing purposes is sufficiently taken care of in virtually all cases by the normal filtration air. Also that human heat and moisture become critical only in summer operation and then only when there are no other means provided for removing it from the air except the ventilation air itself, or where the additional means are lacking in capacity. Dust removal can be equally as well practiced on recirculated air as on outside air. Human odors can be removed by supplying approximately 10 cu. ft. of odor-free air per person per minute. This is a larger quantity than indicated as necessary for any other human reason, and is therefore the minimum quantity necessary for human ventilation purposes. This appears to be the final conclusion so far as present knowledge goes.

It should be kept in mind that this conclusion is not necessarily final. Consideration of the fundamentals does indicate that there is every likelihood that human odor prevention is the real reason for making the use of ventilation air necessary at all. This does not indicate, however, that the presently accepted figure of 10 cu. ft. per person per minute is correct. It may have to be revised upward or downward as this subject is further investigated.

What to Do

The question can now very well be raised as to whether all the older data as given previously in tables in this series are to be totally disregarded. In nearly all cases the values given in them for C_v are substantially greater than 10 cu. ft. per person per minute. The answer is that the degree to which this is done will have to rest with the individual. His reputation and

success are at stake in every job and his own actions will have to rest on his own convictions. There will certainly be many who will be reluctant to depart from a practice which calls for large quantities of ventilation air with the resulting large capacity equipment. Others will no doubt be guided by the desire to keep down first and operating costs where the equipment is so designed and sized that operators will not be able to use more than a moderate amount of ventilation air. Others will prefer to provide for handling large quantities if desired and provide adequate operating control for cutting down the quantity when necessary. In other words what is to be done in a particular case still has to be left to individual judgment but that judgment has more fundamental information to fall back on than was the case years ago when the quantities given in the tables were fixed.



In hospital buildings considerations having to do with bacteria may greatly affect methods of air distribution

Process Ventilation

So far no attention has been given in this discussion to process ventilation problems and the considerations which fix values of C_v, the amount of ventilation air necessary, when they are encountered. We can now turn attention to them.

The same general principle of using no more ventilation air than can be justified applies to them as to human ventilation problems. So also in approaching them we should attempt to fix the objective clearly in mind and then determine the least amount of air necessary to accomplish it.

Process ventilation problems are also similar to those of human ventilation in that the prime object of using ventilation air at all instead of recirculated air is because it is necessary to carry something away from the process and out of the system entirely. Where this is not true, obviously anything can be accomplished by using recirculated air that can be accomplished with new air from outside.

In the same way as was done for human ventilation we can list what it is usually necessary to carry off as: (a) solids, such as shavings, dusts and powders; (b) heat and moisture; (c) odorous substances.

At this point we arrive at one of the principal differences between human and process problems. In human problems, we always have the subjects breathing, giving off heat and moisture, and emitting odors to some degree. Therefore we were justified in considering the fundamental air quantities involved in each item and the largest quantity necessary to meet the requirements of any one would be the minimum ventilation air requirement, for all these items are continually present in human problems. In process problems, though, only one may be involved and the others missing entirely, or all may be present at the same time. This fact, together with the extreme diversity of the processes met with, makes it extremely unlikely that any general simplification of process problems comparable to that which reduces human problems to the odor consideration, will be arrived at. Fundamentally it appears that each process problem will have to be approached individually for a long time to come.

Another complication in process applications is that they so often also involve a human problem at the same time. Cases of process ventilation should not be confused with problems of human ventilation in process (or factory) buildings.

It is notable too that in process problems the general principle applies as in human problems that where there is adequate cooling capacity to withdraw heat and moisture from the air as fast as added there is no necessity to use ventilation air for this purpose.

Process applications also are different from human problems in permitting much wider latitude of approach in that the processes can often be shut off by themselves in airtight compartments in such a way that ventilation air can be passed through these compartments only and not affect the ventilation air quantity necessary in other parts of the building.

Consideration of all these facts leads to the conclusion that while the great spread in the published values of C_v for factory work is lamentable, there is no reason to conclude that this situation can be remedied at present. The only conclusion is that these applications must continue to be given individual attention, and the values of C_v set in the light of the findings.

And in Closing

In previous articles in this series there have been presented virtually all the data commonly available to the designer in attempting to fix values of C_v for substitution in equation (3). After this consideration of the fundamentals in an attempt to see if the lack of specificity in these published values can be remedied, we are brought to the conclusion that in applications where human ventilation is the problem, much specification is possible by accepting the principle that odor prevention is what fixes the value, and that a tentative value of 10 cu. ft. per person per minute appears suitable for present use. Where there are processes other than human to complicate the problem, or when these

processes exist alone, we must still set C_v by consideration of the individual case.

All this goes to show what wide gaps there still are in our fundamental knowledge, and to explain why estimating the heating and cooling load for design purposes is still so largely dependent on judgment.

Nor is this all, for having fixed the value of C_v to meet the requirements of the case, the designer must still decide whether this quantity of ventilation air will really have to be passed through the building at the actual time of the peak load. This consideration affects the size and capacity of the equipment to be installed. It is one thing to make allowances for passing ventilation air through the building under the control of instruments or an operator, and quite another to determine actually whether this air will have to be passed through for the relatively short period that the system operates on peak. Few will want to risk failure by going to the extreme of making no allowance at all for this air in sizing heaters, coolers, fans, and motors, but the anticipated operating methods should be given due weight in making the decision.

On the whole the existing information for determining suitable values of C_v for use in making estimates of equipment capacity are in bad shape in that, in spite of all that has been done, they still involve so much of an element of judgment. If there is to be a successful installation this judgment must be thoroughly sound.

Air Conditioning Prevents Spread of Colds

RECENTLY studies were undertaken by Doctors Wm. J. Kerr and John B. Lagen of California to investigate the transmissibility of the common cold under controlled conditions of environment.

For this purpose an air conditioned room at the University of California Hospital, San Francisco, was used. This room, which provides bed space for four to six patients, is completely isolated from the outside atmosphere, being provided with its own air completely filtered and maintained at any temperature and humidity desired. It contains also an air lock, which permits ingress and egress with a minimum exchange of outside air, and a special lock, which permits service without any break in isolation of subjects. The air lock, which receives the same air as is supplied to the room, contains the recording and controlling instruments and quarters for the experimental investigator who was the only one allowed to enter or leave during the course of the experiment.

The room was maintained at a temperature of 70° to 71°, dry bulb, and 60° to 62°, wet bulb, which is a relative humidity of 55%. The air flow is approximately 66 c.f.m. Barometric pressures were read daily and checked with those of the Weather Bureau. There is a very slight constant positive pressure due to the air being pumped into the room.

The experimental subjects were males between the ages of 21 and 40, who by history had three or more colds per year, the average being five to six, and who had not had a cold within recent weeks. They were placed in the room in groups of three to five and allowed to remain between five and eight days as an incubation period to determine their freedom from an early cold. At the end of this period an individual suffering from a common cold, with onset 12 to 36 hours previously, was brought in and allowed to remain for 24 to 48 hours, the contact being such as exists in normal contacts in a home, namely, eating and playing cards together, use of a common drinking glass, being sneezed at and the like. The experimental subjects were then kept another four to six days in order to have them under observation during the development of any symptoms. In one group of five the degree of exposure was carried to the point of contaminating the thermometers just before readings were made.

Nineteen subjects in five groups of three to four each were so exposed. No common colds or any symptoms referable to a cold were observed in any of the experimental subjects.

Another experiment performed was the inoculation of experimental subjects with material obtained from individuals suffering from a fresh common cold in the first 24 hours. There were two groups in this series, the subjects in each group being exposed to a different donor and comprising five subjects in one group and four in the other. Of these nine subjects inoculated four received the untreated nasal secretions; four received the centrifugalized material; one received heated uncentrifugalized material (control).

In no instance did any of these nine subjects develop any symptoms or signs of a common cold and there were no signs of conjunctival irritation. Five of these subjects had already been exposed to a patient with a cold, and, having developed no symptoms of a cold after an incubation period of five days, were then inoculated directly with the nasal secretions of another donor.

The experiments on a group of 24 presumably susceptible subjects, when kept in an environment arranged for maximum comfort, and exposed to sufferers from a common cold in the early stages, suggest that the common cold is not transmissible under these conditions. The number of subjects exposed and the number of donors to secure results of statistical value is expected to increase.

EDITORIALS

Standards for Air Conditioning

Ever since air conditioning installations began to appear in any volume in commercial type buildings we, as well as many others, have given thought to the situation which was certain to develop when prospective purchasers were faced with proposals carrying cost estimates which varied from each other so widely as to be ridiculous. We predicted that the net result of this condition of affairs would be to create an immediate unfavorable reaction in the mind of the buyers. Concrete evidence is now at hand that this is exactly what has happened. In some cases the reaction has been so unfavorable that purchasers have frankly stated that they do not feel justified in putting their money into installations as long as this situation exists. Having nothing by which to judge the reasonableness of the cost figures presented to them, they simply decide to do nothing. As a result work is being postponed or abandoned altogether. Already the situation is serious enough and it is reasonable to expect that it will get worse before it gets better. No more urgent problem faces everyone engaged in air conditioning work than to find a solution which will eliminate this confusion and reestablish confidence.

All this is doubtless due to a variety of causes. For one thing the buyer needs more and better information as to what he can get so that he can the better decide what he wants. His information on the present status of equipment development, performance and cost is all too meager. From his standpoint this new equipment has appeared too fast for him to keep up with it. In lots of cases he is still confused.

Then there is the matter of estimating sizes and capacities required. These estimates are made by all kinds of people and evidently in all kinds of ways. This confusion also doubtless fundamentally comes from the rapid growth, the lack of adequately trained personnel, and especially from the fundamental difference of opinion between various estimators as to what temperatures, humidities and air quantities are to be used as the base. Behind this lies too the fact that some equipment makers evidently must be wrong as to what their products will do, for it seems impossible that all could be right when they disagree so widely. This particular angle is the more surprising since the parts which go to make up much of the equipment are well standardized and their performance can be determined within rather narrow limits by well established methods.

Analysis of the major causes of the trouble is thus fairly easy. Where the difficulty lies is in trying to straighten it out. Here and there moves have been made to try to work out remedies but they have not met with any general response. Some have been local and some national in scope. It can be fairly said that in spite of the appearance of written rules here and there the whole general problem is now in the early discussion stage.

At this early stage it can be seen clearly that mere compilation of simple rules for computing size and capacity is not going to be enough to fully solve the problem. This phase is important but there must also be:

(1) A classification of words and terms, so all will be using the same language when talking about the same subject; in other words, Standard Definitions.

(2) Very short and brief standards for use of purchasers to permit fixing the limits of maintained and design temperature, humidity, cleanliness, and outside air quantities which will produce a job satisfactory to the purchaser. Within these limits the purchaser or his representative could fix on any necessary details of what he wants. This phase is really Standards of Owner Performance. It should not be confused with standards for use within the industry but these standards should be in agreement with those used by estimators.

(3) Full and detailed uniform rules for determining size and capacity for application and also full information to estimators in order that performance figures and ratings may be correctly and fairly applied, together with a carefully drawn uniform guarantee of performance. A considerable part of this standardization must necessarily be internal between manufacturers and their sales representatives.

Thus it is evident that the problem of standards for air conditioning is at least three-fold if the solution is really to contain all the elements which would give it a chance to be fu'ly effective. Added to this there must be some provision to ensure enforcement after the standards themselves are compiled.

The job is no small order. There are still plenty of questions bound to pop up, and not the least of these are: who is to make the initial moves, who will be able to coordinate such a task, and when will we get going? The present off-season is none too soon to start. Next season the problem will be acute to just the degree that a present solution is not found. No one doubts that there are ways of meeting the situation successfu'ly. They need finding promptly.

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Look to the Big Modernizing Work

Of all the alphabetical agencies of the past three years none has met with better reception generally than FHA with its insured loans and installment payments. Probably most of us are more familiar with the loans first made available with an upper limit of $2,000 and practically restricted to dwellings. Less publicized has been the extension of the upper limit to $50,000 and to business buildings of all kinds. This comparatively little publicity is to be regretted for it is estimated that there are 2,500,000 buildings potentially available for modernizing under this extension. If it were possible to put as much concentrated effort behind finding modernizing work in these buildings as was done earlier for dwellings, the volume unearthed would no doubt be amazing. As it is this extension of the act has resulted in a considerable volume of work. Many a heating engineer and contractor has seen visible and personal demonstrations of how the smaller loans worked to his advantage. The general report is that it took individual work to find these cases, and so does it take personal effort to find these larger opportunities. Work in buildings of this kind on jobs of substantial size is the kind which has been so scarce, and which so many contracting firms are well equipped to do. We predict that those who recognize this opportunity and really go out after it are going to find their efforts well paid between now and next April when the credit insurance feature expires. Apartment houses are an especially promising field as are also retail stores, small factories, and hospitals and institutions. The heating plants in virtually all of these are old and in many cases outmoded. With the developments in new equipment it will be rare indeed to find one where it cannot be shown that a moderate amount of improvement will provide enough actual savings to provide for making the installment payments over less than the repayment period provided. The extension of the loan limit is a real opportunity to those who are alert to the situation.

ABSTRACTS of Current Papers, Books and Pamphlets

New Series of Practical Booklets

Two booklets of interest to heating men, "Electric Motors for Air Conditioning and Heating Equipment" (No. 201) and "Cooling Buildings with Ice—Design and Installation of Ice Cooling Apparatus in Small Buildings" (No. 246), are included in a new collection of booklets entitled Machinery's Yellow-Back Series. This is a new series of single-subject booklets published to meet the demand for small inexpensive monographs in condensed form on selected subjects. They are specific in character and give facts likely to be of the greatest practical value.

The complete series includes 50 booklets, most of which relate to production or design in the machine shop field. Other booklets which should be of interest to designers of heating and ventilating equipment for manufacturers include:

"Electric Motors—What the Machine Designer Should Know About Them" (No. 200).

"Electric Motor Maintenance—How to Avoid Motor Troubles and Repair Bills" (No. 202).

"Stainless Steels—Composition, Strength, Applications, Machinery, Drawing and Polishing" (No. 206).

"Lubrication of Ball and Roller Bearings—Results of Extensive Tests" (No. 208).

"Shop Managers' Problems—and Solutions which Have Proved Successful" (No. 218).

"Perspective Drawing—Simple Diagrams and Examples Illustrate Principles" (No. 220).

"Patents—What Inventors Should Know About Them—Part I" (No. 221).

"Patents—What Inventors Should Know About Them—Part II" (No. 222).

"Patent Questions—and their Answers" (No. 223).

"How to Write a Technical Article" (No. 224).

"What Every Shop Foreman Should Know" (No. 228).

"How to Paint Machinery—and Get a Durable Attractive Finish" (No. 229).

"Pipe and Tube Bending—How to Prevent Buckling at Bends" (No. 230).

"Metal Spinning—For Smoothing Drawn Shells and for Forming Shapes too Difficult for Drawing in Dies" (No. 239).

"Arc Welding—Types of Welds, Sizes, and Allowable Loads—Part I" (No. 240).

"Arc Welding—Practical Pointers on Welding Methods—Part II" (No. 241).

"Machine Shop Arithmetic—Practical Problems for Machinists, Toolmakers, Foremen—Part I" (No. 244).

"Machine Shop Arithmetic—Practical Problems for Machinists, Toolmakers, Foremen—Part II" (No. 245).

[*"Machinery's Yellow-Back Series." 50 small books by various specialists in engineering and manufacturing practice; 1¼ to 22 pages, 5 1/2 x 8 1/2 in. Published by the Industrial Press, 148 Lafayette St., New York. Price 15 cents each; 8 for $1.*]

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Gravity Warm Air Heating

For a period of over 16 years the Engineering Experiment Station of the University of Illinois has been investigating and gathering information on warm air furnace heating. From time to time the results of the investigations have been published in bulletins issued by the Station. While these circulars cover practically all of the work of the Station on the subject, they are rather difficult to use because information on any one subject is scattered throughout all of the bulletins.

It was with the idea of gathering together the information in a more usable form that this book was compiled. In order to do this as much as possible of the original text material is presented in its original form. The only material omitted is tabular data and descriptive matter which would be of little interest to the reader and some of the experimental work on forced air circulation. Any additions that have been made have been done with the idea of unifying, clarifying, and summarizing the various sections.

The editor is to be congratulated on the excellent job that he has done in compiling this book. The book should prove extremely valuable to all those interested in either the design, manufacture, or installation of gravity warm air heating systems.

[*"Gravity Warm-Air Heating," edited by James D. Hoffman and published by the National Warm-Air Heating and Air Conditioning Association, Columbus, Ohio. Cloth-binding; 6 in. x 9 in.; 516 pages; price $2.*]

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Heating With Combustible Liquids

This book is good evidence of the activity of the oil burner industry in France. It is a large book and covers in considerable detail the theory and operation of burners for a great variety of liquid fuels. A large number of sketches and graphs are used to illustrate the text. The book is written entirely in French.

Among the subjects treated are general and historical information on combustible liquids, storage of combustible liquids, vaporizing burners, air atomizing burners, mechanical atomizing burners, control and safety devices, oil burner accessories, types of equipment.

[*"Le Chauffage Par Les Combustibles Liquides," written by A. Guillermic and published by Librairie Polytechnique Ch. Beranger, 15, Rue Des Saints-Peres, 15, Paris. Cloth-bound; 6 in. x 9 in.; 394 pages; price 110 francs plus postage.*]

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Power Operator's Guide

This book is a compilation of kinks, schemes and pointers which have appeared in "Power" during the past seven years. The idea behind the book is to provide a classified compilation of these helps in a readily usable form. There are 1001 ideas in the book classified by subject into 19 chapters.

Although the major portions of the book deal with such subjects as power generation, oil and gas engine repairs, and air compressors, a large amount of space is devoted to subjects of interest to men in heating and air conditioning work. Approximately 150 pages in the front of the book present ideas on fuel, furnaces, feed water treatment, boilers, superheaters and like subjects.

Perhaps the chapter on building services will be of greatest interest, for here one will find 67 short cuts and labor saving ideas on heating, ventilating, air conditioning and hot water equipment. Other chapters cover such subjects as gages and meters, mechanical transmission, bearings and lubrication, piping, valves, fittings, refrigeration and tools.

[*"Power Operator's Guide," compiled by E. J. Tangerman and published by the McGraw-Hill Book Company, New York. Flexible binding; 6 x 9 in.; 568 pages. Price, $4.*]

(Continued on page 74)

NEWS OF THE MONTH

Creviston, Adams, Head Housing Conference

WASHINGTON.—As a result of a conference of 33 representatives of the durable goods industry, called by Peter Grimm, assistant secretary of the Treasury, and formerly a real estate broker of New York, a housing display conference has been organized to provide a new and powerful stimulus to housing construction and modernization.

Russell G. Creviston, advertising and sales promotion manager, Crane Co., Chicago, was elected chairman of the conference and Marshall Adams, sales promotion manager, American Radiator and Standard Sanitary Corp., New York, was elected vice-chairman.

Mr. Creviston announced that plans were discussed for a series of country-wide exhibits to demonstrate moderate cost housing, materials and modern appliances and equipment.

There was agreement that the undersupply of housing in the United States was large and that in the coming year no less than 750,000 housing units would be built. Considerable importance was attached to the fact that not less than half of all the building activities in this country during a given year took place in communities of 5,000 population and less. The permanent home shows could not be expected to reach a great many of these small communities because of their isolation. To meet this condition, a motor caravan housing show is being planned. It is expected that no less than nine permanent housing shows will be set up immediately.

N. Y. Burner Men Organize

NEW YORK—The present rule situation regarding the installation of oil burner equipment in this city has become such that a number of oil burner firms have organized a committee for cooperating with the city authorities in an endeavor to obtain an equitable and clarified set of rules under which the industry may profitably operate. The committee has formed a permanent setup called Oil and Allied Industries, Inc.

It is headed by J. T. McTarnahan, Petroleum Heat and Power Company; Lionel Jacobs, Electrol Incorporated; F. C. Schoen, Bethlehem Steel Corporation; E. H. Peabody, Peabody Engineering Corporation; Hans Lieblich, Johnson Oil Burners; Jack Kaplan, Ray Oil Burners; F. S. Harper, Coen Company, Inc.; Earl Marr, representing the Oil Burner Institute, Inc.; I. A. Heimlich, General Counsel, representing the National Oil Burner Dealers Association, and Mr. Flynn, Todd Combustion Equipment Company, Inc.

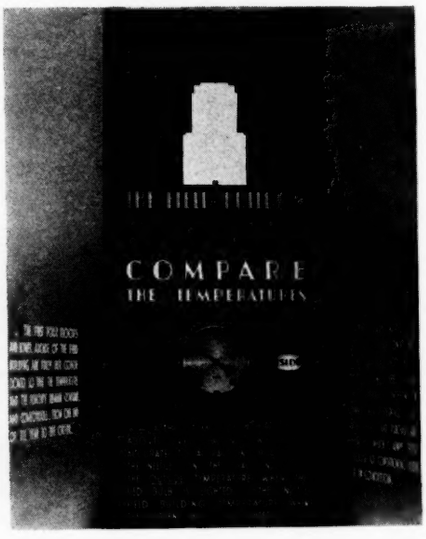
Coal Research Program Under Way at Battelle

COLUMBUS, OHIO—In connection with the study of the characteristics of coals for underfeed stokers sponsored by Bituminous Coal Research, Inc., at Battelle Memorial Institute here, three types of underfeed stokers have been selected for the initial tests. All of the stokers are of the residential sizes.

The characteristic feature of one is that the worm moves continuously when the stoker is operating. In another of the machines the worm is moved intermittently by a ratchet and pawl device. The basis of selection of the third stoker was the number of retorts and tuyeres available and their ease of change. Special furnaces have been designed and built for these tests. The entire stoker and furnace assembly is to be mounted on scales so that the rate of burning may be accurately known at any time.

35,045 Gas Heat Jobs in Chicago

CHICAGO—According to a recent report of the Peoples Gas Light & Coke Company, and the Public Service Corporation of Northern Illinois, there are now 35,045 gas heating customers in the Chicago area. Eighty per cent of these installations are in residences and apartment buildings.



Promotional possibilities of air conditioning are capitalized upon by the Field Building, Chicago's newest skyscraper, which has installed this thermometer display in a large La Salle Street window. The switching of the hand from hot outside temperatures to the cool inside figure has been an object of interest for thousands who pass the building daily.

Organize to Standardize Building Codes

NEW YORK—Rudolph P. Miller, dean of American building code authorities, was elected chairman of the American Standards Association building code correlating committee September 17 when the committee was organized. George N. Thompson, National Bureau of Standards, was named vice-chairman.

The organization of this committee gives a much needed impetus to a necessary movement for cleaning up worry of the present confusing conditions in the building code field. Talk of securing more rational and economical standards for building construction has at last crystallized into definite action.

The correlating committee will supervise the work of several sectional committees which will be assigned to develop building standards and specifications. These will be made available to municipalities in developing their own building codes, and in this way the collected experience of national organizations can be passed on to the local bodies.

Today there are more than 1,600 building codes in the United States, many of which vary widely as to construction requirements. It is expected that the work of this committee will serve to make building requirements more uniform.

ASA was asked to undertake work on a national building code by Secretary Roper of the Department of Commerce, when the Department's building code committee was disbanded. The Bureau of Standards has offered to continue its researches in this field, and will cooperate closely with the ASA committees.

A.C. for Block of Montgomery's Stores

MONTGOMERY, ALA.—Soon New Orleans will not be the only southern city to boast of a completely air conditioned block. A block in Montgomery on Dexter Avenue is well on its way to air conditioning fame. There are already three large 5 & 10 cent stores air conditioned and another large chain store organization plans to build a modern air conditioned store in this block.

The largest stores operating air conditioning systems in this block are J. J. Newberry Company, S. H. Kress Company, and Silver's. Others have air conditioning in some form. Klein and Son and Montgomery Fair, both in the same block, are dealers respectively for Chrysler's Airtemp and Frigidaire air conditioning equipments.

TVA Heats Houses Electrically

MUSCLE SHOALS, ALA.—The first village in America entirely heated with electricity is the claim made for Pickwick, the Tennessee Valley Authority town, built in southwestern Tennessee to house workers on the $38 million Pickwick Landing Dam. The village has 125 houses, an administration building, recreation hall, hospital, store, two schools, and a cafeteria.

On cool days, as the temperature of a room falls, a thermostat automatically turns on the heat. When the room reaches a certain temperature, the thermostat shuts off the current.

The individual room heating method was adopted. The heating units, usually placed under windows, are a combination of radiant and circulating types. The TVA estimates that the initial cost of installations was approximately 50% less than the cost of a steam or hot water system of heating.

The TVA first introduced electric heating at Norris, Tenn., the town it built for workers on the Norris Dam. However, only a small number of the 350 houses are heated electrically.

128 Exhibitors for Exposition

NEW YORK—To make it possible for its members conveniently to attend the Fourth International Heating & Ventilating Exposition, which is to be held at the new International Amphitheatre in Chicago, January 27-31, 1936, the National Warm Air Heating & Air Conditioning Association has changed the date of its national meeting to coincide with the Exposition. Instead of its usual date in December the Association will meet at Chicago during the week of January 27.

The ASHVE, under whose auspices the Exposition is presented, will follow its usual custom of holding its annual meeting during the same week and in the same city. The Palmer House has been chosen as headquarters and J. H. Milliken is chairman of the committee of arrangements. John Howatt, president of the ASHVE, will preside at the opening sessions.

Four months in advance of the date of the Fourth Exposition 178 spaces in the amphitheatre have been taken by 128 exhibitors. To meet demands for space it was necessary more than a month ago to reserve the south wing of the amphitheatre which offers space equal to that already taken.

Principal sections of the Exposition will include boilers and furnaces, steam, air, and hot water heating systems, hydraulic equipment, air conditioning apparatus of every type, ventilating systems, refrigerating systems, central heating and unit heating, insulation materials, and precision instruments to provide regulation and control for every type of installation, whether in home, office, or factory.

O.B.I. Committee Approves Seal

BALTIMORE—The executive committee of the Oil Burner Institute met here September 17 and reviewed with G. Harvey Porter, managing director, the steps being taken to give effect to the new expansion program of the Institute. The committee considered and passed upon a design for the OBI seal of approval, rules governing the use of which will be determined by the board of directors at its next meeting.

The board will also be asked to decide on requirements for membership in the industrial, distillate, and associate groups which were recently established.

Buffalo Chapter Opens Season

BUFFALO—The Western New York chapter, ASHVE, inaugurated its fall program with a golf meet and dinner at the Erie Downs Country Club, Ft. Erie, Ontario, September 9. Thirty-two members and guests were in attendance.

Prizes for golf were awarded to Earl Zimmerman, Walt Voisinet, Dave Mahoney, John Landers, Bert Candee, and Myron Beman.

Chapter President Voisinet made a preliminary announcement regarding the October 14 dinner and meeting, to be held at the Touraine Hotel, Buffalo.

A.C. for Newspaper

LOUISVILLE, KY.—The *Louisville Courier-Journal* and *Times* has installed air conditioning equipment in the building which houses its offices, mechanical departments and radio station WHAS Well water is used for cooling.

A.C. Up in Houston

HOUSTON—There has been a sharp increase in the number of air conditioning installations made in this city in the first eight months of 1935 as compared with the same period last year, according to information received from Elmer Wilson, Power Sales, Houston Lighting & Power Company. From January to August inclusive of this year 2,297¾ hp. were installed as compared with 341 hp. in the same period of 1934. The number and size of these installations grouped according to type of building in which they are installed are shown in the following tabulation:

AIR CONDITIONING INSTALLATIONS IN HOUSTON, TEX.

TYPE OF ESTABLISHMENT	FIRST 8 MONTHS, 1935			FIRST 8 MONTHS, 1934		
	NO.	HP.	TONS	NO.	HP.	TONS
Commercial	19	1960¾	596½	19	118	89½
Public & Institutional	1	18	11½	—	—	—
Residential	4	16	11½	6	47	27
Theater & Recreational	3	303	160	2	176	118
TOTAL	27	2297¾	779½	27	341	234½

15 A.C. Jobs in Mass. City

SPRINGFIELD, MASS.—Fifteen air conditioning installations were made in this city in the first six months of 1935. These are as follows:

	NO.	HP.
Restaurants	3	32
Offices	6	191
Funeral parlors	1	9
Hotels	1	20
Printing shops	1	9
Stores	2	11½
Residential	1	1½
TOTAL	15	274

Gas Heating and A.C. on AGA Program

NEW YORK—Sales stimulation, research in gas air conditioning, improvements in gas appliances, and celebration of the 10th anniversary of the gas industry's testing laboratory at Cleveland, are among the subjects on the program of the 17th annual convention of the American Gas Association to be held at the Palmer House, Chicago, October 14-18.

Delegates representing 300 manufactured gas companies, 200 natural gas companies, and 400 manufacturers of gas appliances and apparatus are expected to attend the convention. An attendance of 3,000 is anticipated.

Among the speakers on the program will be Herman Russell, president of the Rochester Gas & Electric Corporation, who will discuss Economics of Securing the House Heating Load.

Inland and Ryerson Merge

CHICAGO—At the special stockholders' meeting of Inland Steel Company held September 20, the plan of reorganization to effectuate the union of the business of Inland Steel Company with that of Joseph T. Ryerson & Son, Inc., was approved.

The charter was amended by increasing the authorized no par value shares from 1,200,000 to 1,600,000, of which 240,000 shares were authorized to be issued for the acquisition of all of the assets, business and good will of the Ryerson Company.

Edward L. Ryerson, Jr., Joseph T. Ryerson, and Everett D. Graff were added to the board of directors of Inland Steel Company. J. H. Morris was also elected a director.

Utility Conditions Offices

STAMFORD, CONN.—A complete summer air conditioning system has been installed by the Stamford Gas & Electric Company to cool, filter, and dehumidify the air throughout the ground floor of its office building at 429 Atlantic Street. Cashiers', credit and customers' service departments are included in the cooled area of 130,000 cu. ft., as well as a large space devoted to display of gas and electric appliances.

The system employs a Bryant silica gel No. 30 dehumidifier in conjunction with a compressor for cooling. Part of the air enters the dehumidifier from the outside and part from air returned from the conditioned spaces. After being dried, the air passes through a filter and then around coils connected with the compressor.

The system has a heat removal capacity of 21 tons. It is so designed that either the dehumidifier or the compressor can operate alone when the demand is for one or the other. Temperature and humidity are controlled by a combination thermostat and humidistat.

Dehumidifying equipment was installed by The Bryant Air Conditioning Corporation, while the cooling installation was made by the Connecticut Electric Refrigerating Co., New Haven, Westinghouse air conditioning dealer for Connecticut. Ductwork for the installation was fabricated and erected by the Richards & Jessup Co., Inc., Stamford.

Refrigerating Machinery Builders to Meet

WASHINGTON—The annual meeting of the Refrigerating Machinery Association, which will convene October 11 at the Palmer House, Chicago, will be marked by initiation of a broad equipment standardization program to be recommended to the association by its executive and standards committees. Preparation of this program has been intensively carried on by the RMA Standards Committee over the past several months.

A proposed code of Standard Methods for Testing Mechanical Condensing Units has been prepared by a joint committee composed of representatives of the manufacturers' associations and the ASRE and ASHVE, and will be considered for adoption by the RMA.

A.C. for Holyoke Office

HOLYOKE, MASS.—The Holyoke Water Power Company has ordered the installation of a complete year 'round air conditioning system which will remove all radiators from its office building and put in a duct system for carrying conditioned air to all offices during the winter season.

Dillon Heads Steel Boiler Group

BUFFALO—J. T. Dillon, Jr., president of Struthers-Wells-Titusville Corporation, was elected president of the Steel Heating Boiler Institute at a meeting here September 18. Homer Addams, president of Fitzgibbons Boiler Company, and W. R. Meikle, of the steel boiler division of Burnham Boiler Corporation, were elected vice-presidents, and R. A. Locke, secretary and treasurer.

The directors, in addition to Messrs. Dillon and Addams, are: J. R. Collette, vice-president, Pacific Steel Boiler Division; Chas. Crouse, vice-president, National Radiator Corporation; R. N. Dickson, president, Kewanee Boiler Corporation; F. B. Metcalf, president, International Boiler Works; H. H. Peek, president, Lookout Boiler & Manufacturing Company; John Trefts, president, Farrar & Trefts, and C. N. Tull, president, Spencer Heater Company.

Course in A.C.

NEW YORK—A third course in air conditioning will be given at the New York Y.M.C.A. Schools, 5 West 63 Street, starting October 7 at 8 p.m., under the instruction of William H. Stangle.

This course has been prepared to present the principles of air conditioning in an understandable manner and the purpose of which is to qualify students for positions in the field as maintenance men, salesmen, and installers of air conditioning equipment. The subject matter has been arranged in subject series comprising lectures, examples, problems, actual demonstrations and examinations.

Individuals interested in this course may obtain a folder describing air conditioning and also a pass to the opening session.

R. & B. Reorganized

NEW YORK—An order signed by Judge Henry W. Goddard of the U. S. District Court for the Southern District of New York, on September 13, completed the final step in the reorganization of Richardson & Boynton Company. The reorganization was deemed advisable some months ago as a means of rearranging the capital structure of the company. Under the plan approved by the court, all classes of creditors and stockholders were provided for equitably. During the proceedings, the officers of Richardson & Boynton Company were continued in charge.

Additional working capital has been supplied through a Federal Reserve loan, part of which will go to former creditors. It is expected that the company will strengthen both its manufacturing and sales divisions.

A.C. Loans for Newspaper Employes

CHICAGO—Air conditioning, which has been successful in Tribune Tower and throughout the editorial and other departments of the *Chicago Tribune* is now available for homes of the 1,950 employes of this publication who live in Chicago and suburbs. At a meeting of the directors of the Medill Building and Loan association recently it was decided to make loans available for all employes who desire to install temperature control in their homes.

With that end in view it was voted to conduct a survey among all Chicago and suburban employes of the paper to determine those who wish to install air conditioning in their homes and what kind and size of service they desire.

For those who want this modern feature the Medill Building and Loan association will finance installation up to a cost of $1,000. This will be available to all employes whether members of the loan association or not, according to J. P. Kreutzer, recently re-elected president.

Lowered Gas Rates in N. J.

NEWARK, N. J.—With the new gas rates which Public Service Corporation of New Jersey will put into effect October 1, a budgeted plan of billing, liberal financing arrangements, a new advertising campaign and a "try it before you buy it" plan will be adopted as promotional activities in the interest of the sale of gas for house heating, J. P. Leinroth, general industrial fuel representative, Public Service Electric and Gas Company, told 125 architects, builders and real estate men recently.

Mr. Leinroth was the principal speaker at a dinner meeting in the Canoe Brook Country Club where the architects, builders and real estate men, all located in the territory served by the Essex Division of the company were guests of Public Service.

Under the proposed new billing system, the customer may pay 10% of his annual fuel bill each month for ten months.

"This will eliminate the peak bills in the cold months and should have the effect of correcting many wrong impressions about the cost of gas for house heating," Mr. Leinroth said.

The general fuel representative also explained the liberal financing arrangements offered by the company as well as the "try it before you buy it plan." Under this plan, the customer will be permitted to try gas for one heating season and if he does not like it at the end of that time the company will take the installations out and restore the customer's previous heating system.

Colonial Beacon Buys Ballard

BOSTON — Arthur H. Ballard, Inc., New England manufacturer of oil burners for 18 years, has been purchased by the Colonial Beacon Oil Company. No change in policy or personnel will be made and the organization will continue marketing the Ballard burner. J. J. Kelley will remain as general manager.

Mr. Ballard, who founded the firm in Boston in 1917 after experience in oil heating on the West coast, is retiring, and his property was purchased by Colonial Beacon, an Esso Marketers affiliate, in accord with the Esso Marketers policy of expanding their burner marketing facilities.

Colonial Beacon, which has been marketing the Gilbarco burner will continue to do so, while the Ballard organization will handle Ballard burners exclusively.

For some time prior to the purchase, Ballard had been marketing oil fuel supplied by the Colonial Beacon company under the name Beacon Heating Oil, but for the past year has been handling Essoheat, which it will continue to do.

The Colonial Beacon company is affiliated in its operations with the Standard Oil Company of New Jersey as one of the Esso Marketers. The latter was the first major oil company to sell oil burners under a "United Responsibility" plan which was initiated in Washington in 1932. Its success there resulted in its expansion to Newark, Baltimore, Richmond, and Charlotte. In Philadelphia, the same plan is offered by the Standard Oil Company of Pennsylvania, while the Sylvestre Oil Company, another affiliate, offers it in New York.

COMING EVENTS

OCTOBER 14-18, 1935. *Seventeenth Annual Convention of the American Gas Association, Chicago, Ill.*

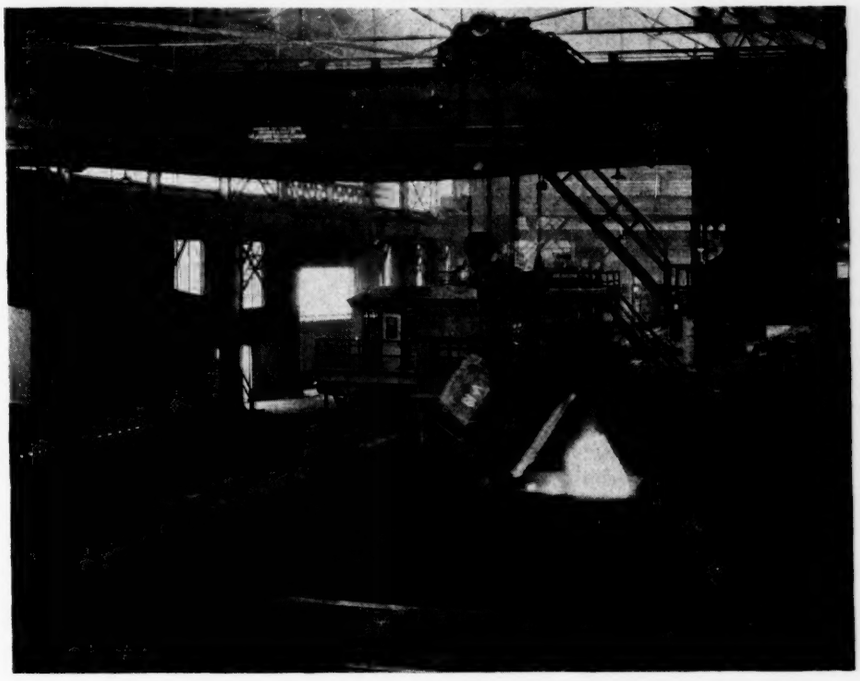
OCTOBER 14-18, 1935. *Midwest Power Show, Chicago, Ill.*

DECEMBER 5-6, 1935. *Eleventh Annual Conference on Welding, Purdue University, Lafayette, Ind.*

JANUARY 27-30, 1936. *National Warm Air Heating and Air Conditioning Association Convention, Hotel Stevens, Chicago, Ill.*

JANUARY 27-31, 1936. *Annual meeting of the American Society of Heating and Ventilating Engineers, Palmer House, Chicago, Ill.*

JANUARY 27-31, 1936. *Fourth International Heating and Ventilating Exposition, International Amphitheatre, Chicago, Ill.*



AIR CONDITIONED CRANE CAB

In order to improve the working conditions of crane operators working over extremely hot metal where the cab temperatures frequently attain 120°, A. M. Byers Co., Pittsburgh, installed cooling units in the cabs to maintain inside temperatures between 70 and 75°. The cold air inlet is located in the corner of the cab farthest from the operator and the return outlet in the corner nearest the operator. Sides and floors of cabs are insulated with asbestos sheathing 1 1/8 in. thick. The cooling unit is mounted on the tops of the cabs, as shown.

A.C. for Denver Night Club

DENVER — Complete, year 'round air conditioning made its Denver debut in the cafe and night club field recently with the opening of La Casanova, dining and dancing place in the Brown Palace hotel.

The air conditioning system is one of the few of its kind and size in the city. The other comparable systems are in large theaters.

Generator Sets for Precoolers

WASHINGTON—The Washington Terminal Company is providing for the precooling of cars in the Union Depot here with a fleet of 21 portable generator sets to charge the batteries and serve as an auxiliary power supply to operate refrigerating units while cars are at a standstill.

These units are Harnischfeger semi-automatic motor generator sets, consisting of an a.c. squirrel cage motor, direct connected to a low voltage d.c. generator and the necessary control apparatus. Being portable units designed for outdoor service, they are used either in the yards or on the station platform, and, with an output of 300 amperes direct current at from 40 to 45 volts, have ample capacity to serve two railway cars at the same time.

A.C. Up in Birmingham

BIRMINGHAM—Horsepower rating of air conditioning installations made in this city in eight months of 1935 ran 1,600% ahead of installations made during 1934, according to a report by the Birmingham Air Conditioning Bureau and the Birmingham Electric Company. The city now has 45 installations, 21 of which were made during 1935, and all but 11 since the beginning of 1934. This does not take into consideration the load added from standby railroad cars.

The big showing was partly due to the $100,000 350-ton installation for the new department store of Loveman, Joseph & Loeb, which alone carries a rating of 548 hp.

Installations made during 1935 included five in offices, three in residences, nine in restaurants and stores, one in a theater, one in an automobile show room, one in an automobile service station, and one in a radio station. No industrial installations were made.

Efforts of the Air Conditioning Bureau have been to get at least one installation in each type of business in the belief that others in the same lines will eventually fall in line. To this end the Bureau advertises the first installation freely in the newspapers with such headlines as "Shoe store installs air conditioning," or "Jewelry store provides for comfort of its customers."

William M. Treadwell

NEW YORK — William M. Treadwell, manager of the New York office of Warren Webster & Co., Camden, N. J., died of a heart attack September 7 while playing golf at the Ridgewood, N. J., Country Club, near his home.

Mr. Treadwell, who was 58 years of age, had been connected with Warren Webster for the past 36 years. He is survived by his widow and three daughters.

WITH THE MANUFACTURERS • • • •

American District Steam Co., North North Tonawanda, N. Y., has appointed V. L. Sanderson as its sales representative in Philadelphia and Delaware, with headquarters at 1108 Otis Building, Philadelphia.

The American Foundry Equipment Co., 555 Byrkit St., Mishawaka, Ind., has appointed Martin H. Kidder to supervise advertising, sales promotion and publicity on such products as the company's electric unit heaters and other equipment. Mr. Kidder was formerly with Link-Belt.

Carbondale Machine Corp., Harrison, N. J., recently reorganized as a subsidiary of Worthington Pump and Machinery Corporation to cover the manufacture and sale of all classes of refrigeration, ice manufacture and air conditioning equipment, has announced officers and directors as follows: H. C. Ramsey, president; H. A. Feldbush, vice-president; A. H. Baer, vice-president in charge of sales; A. L. Prentice, secretary and treasurer; W. Lehman, assistant secretary and assistant treasurer; F. D. Talmage, assistant secretary and assistant treasurer; C. A. Packard, comptroller; directors, A. H. Baer, H. C. Beaver, Hugh Benet, H. A. Feldbush, H. C. Ramsey, C. E. Searle, and C. E. Wilson.

Combustion Engineering Co., Inc., New York, has appointed Don S. Walker district manager in its Philadelphia office, and responsible for sales in the Philadelphia and Washington territories. Mr. Walker is a former president of the Mercon Regulator Company, from which he resigned in 1924 to become president of the Illinois Barge Line Company which was later merged with the John I. Hay Company of which he was made vice-president and chief engineer. He joined Combustion Engineering Company in 1934.

Corning Glass Works, Corning, N. Y., announces that its heat absorbing window glass, described in recent technical publications and illustrated on page 60 of the September, 1935, issue of HEATING AND VENTILATING, is being manufactured and marketed by Libbey-Owens-Ford Glass Company under the trade name "Aklo." The glass was developed by the Corning Glass Works.

Dail Steel Products Co., Lansing, Mich., has appointed Perego Corp., Milwaukee, Wis., as distributor for eastern Wisconsin.

Davis Engineering Corp., 1064 East Grand St., Elizabeth, N. J., has appointed Arthur W. Clark, formerly managing secretary, dealer division, American Oil Burner Association, and executive director, National Oil Burner Dealers Association, as general sales manager with headquarters at the Davis factory at Elizabeth. The company intends to increase its representatives in the oil burning territories through an active sales campaign aimed at providing sales promotion and assistance that will stimulate sales among manufacturers, jobbers, and dealers on the products made by the company.

J. H. France Refractories Co., Snow Shoe, Pa., has opened a New York office at 101 Park Avenue. This office will be under the supervision of Ralph B. Cassady, refractories engineer, who will give assistance in the handling of refractory problems of every nature.

The Hoffman Specialty Co., Inc., Waterbury, Conn., has acquired the patents of the Webster Tallmadge Company and will hereafter manufacture, sell, and engineer the Hoffman-Tallmadge system of zoned controlled heat.

This company has also been licensed by the W. A. Russell Company for rights on adjustable port venting valves. Under a cross agreement the Hoffman Specialty Company has in turn given a manufacturing license to the Russell company under certain of the Hoffman patents.

Holcomb & Hoke Mfg. Co., Indianapolis, Ind., has appointed the Iroquois Coal Co., Chicago, as distributor of its stoker in Illinois and Wisconsin. The company has also appointed the Horace Link Co., Paris, Ill., to cover certain parts of Illinois and Indiana. Indiana dealers include F. W. Hubner, R. J. Morgan, O. F. Reynolds, and Stockton Company. The Belden Porter Company will sell the stoker in Minnesota and John Livingston in New York. The Banner Heating Company has taken on the contract in Ohio. The James Arthur Smith Co., Birmingham, Ala., will sell the stoker in that territory.

Joliet Heating Corp., Joliet, Ill., has appointed the Chicago Airtemp Corporation as distributor for its products in 36 counties of Illinois, Indiana, and Wisconsin.

The Kennedy Valve Manufacturing Co., Elmira, N. Y., has appointed William Godbey as its representative in Kansas, Nebraska, western Missouri, and southwest Iowa.

National Radiator Corp., Johnstown, Pa., announces that the National-Williams boiler-burner units are in production and being sold under the direction of C. P. Culbert, manager of the company's oil heating division.

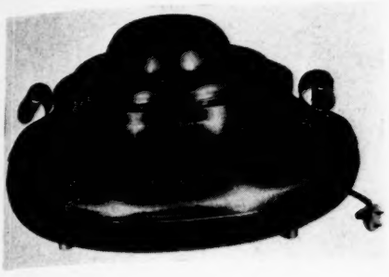
Penn Electric Switch Co., Des Moines, Ia., has appointed Burton E. Shaw as chief of its research department. Mr. Shaw had been sales engineer prior to his new appointment and formerly was with the Gilbert & Barker Manufacturing Company as consulting engineer and research chief.

The Permutit Co., 330 West 42 St., New York, has appointed E. L. Horiskey as domestic sales representative covering Nebraska and Iowa, with quarters at Omaha, Neb.

H. W. Porter & Co., Newark, N. J., has appointed the following distributors: Reid Hayden, Inc., with offices in Baltimore, Washington, Richmond and Charlotte, to cover Maryland, District of Columbia, Virginia, and North Carolina; Brooks-Fisher Insulating Co., Atlanta, to cover Georgia and Florida; Asbestos & Magnesia Materials Co., Chicago, to cover Illinois; General Asbestos & Supply Co., Inc., Indianapolis, to cover Indiana and Kentucky; The Nicely Corp., Philadelphia, to cover Pennsylvania and Delaware; Taylor-Seidenbach, Inc., New Orleans and Birmingham, to cover Louisiana, Mississippi, and Alabama; Johns-Manville Sales Corp., St. Louis and Kansas City, to cover Missouri and Kansas; Johns-Manville Sales Corp., Omaha, to cover Nebraska and South Dakota. New York State will be handled by Asbestos Construction Co., Inc., New York, Johns-Manville Sales Corp., Albany, and Smith-Murray Corp., Syracuse. Texas will be handled by Aycock Corp. of Texas, Houston, and Johns-Manville Sales Corp., Dallas. Connecticut will be handled by Johns-Manville Sales Corp., Hartford; Wisconsin by Milwaukee Insulation Co., Milwaukee; Massachusetts by Johnson Asbestos Co., Springfield, and Oklahoma by Johns-Manville Sales Corp., Tulsa.

Richmond Radiator Co., Uniontown, Pa., has announced a full operating schedule for the manufacture of boilers, radiators, and enamelware following its purchase by Reynolds Metal Co., Inc., New York. G. A. Robertshaw has been elected chairman of the board, and R. S. Reynolds is a director, H. M. Kelly is secretary and assistant treasurer, H. F. Hagendoran, treasurer, and C. C. Adams is manager in charge of sales. The general offices of the company are at Uniontown.

NEW EQUIPMENT



Walton Portable Humidifier

The American Gas Accumulator Co., Elizabeth, N. J., is marketing the improved Walton portable humidifier. This device, which needs only to be plugged into an electrical outlet and filled with water, draws 25 watts which is the only energy needed. The rotation of the motor drives a hollow shaft which pulls water up from the reservoir and discharges it at high velocity to a comb-like affair which further breaks up the water drops. No heating coils are used.

The device evaporates 1½ pt. per hr., the container holding 2 gal. It is made of statuary bronze, is 15 in. in diameter and 9 in. high. The motor is of the capacitor type.

Bailey Adjustable Orifice

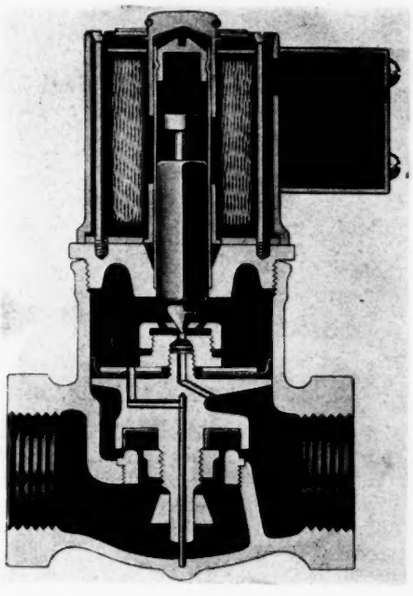
An adjustable orifice which automatically shifts its position in accordance with major changes in rate of flow is a development of Bailey Meter Co., 1050 Ivanhoe Road, Cleveland. This device, when installed in a pipe line and connected to a standard recording and integrating fluid meter, greatly widens the flow range which may be accurately covered by the meter.

The orifice is similar in appearance to a hydraulically operated gate valve. The gate, however, is a sharp edged orifice segment, coefficients for which have been accurately determined. Its position varies the size of the orifice opening through which the fluid measured must pass.

Movable stops limit the stroke of the hydraulic piston so that the orifice segment rests in either one of two definite positions. The piston which positions the orifice is actuated by a solenoid operated valve, which in turn is commanded by contacts made in the recording meter. Through the solenoid valve, hydraulic pressure is admitted to either end of the cylinder and the other end is opened to drain.

When the differential pressure across the adjustable orifice reaches a predetermined minimum or maximum, a contactor within the meter casing energizes the solenoid valve, automatically changing the orifice opening to correspond with a new capacity. Simultaneously with this change, the integrator drive is shifted to a second Warren motor so it continues to accurately measure the total flow regardless of the orifice position. In addition to changing the orifice position and integrator speed, the contactor also energizes a small solenoid which operates an auxiliary recording pen to show the proper multiplying factor to be applied to the corresponding flow record on the chart.

Under an increasing flow condition, the orifice shifts position at a higher rate of flow than it does under a decreasing flow condition. This overlap prevents constant shifting when conditions are such that the flow holds closely to the changeover point.



Powell Valve

The Wm. Powell Co., Cincinnati, Ohio, has introduced the type B electro-hydraulic valve, especially adapted for refrigerant service. It may also be used for water, oil, or air.

The bodies are of the globe type with screwed, flanged or solder joint pipe ends. Power consumption is approximately 12 watts.

When the electric pilot valve is closed a hydraulic pressure is built up in the upper portion of the valve body through a bypass in the valve stem which overcomes the line pressure and forces the valve closed. When the pilot valve is electrically energized it opens and releases the hydraulic pressure, thus permitting the line pressure to open the main valve. The valve is made in sizes from ¼ in. to 3 in.

Cadet Automatic Burner

Sto-Coke Inc., Indianapolis, Ind., has placed on the market an automatic burner designed to burn any size coke.

It is claimed that the burner can be installed in any heating plant in two or three hours by removing the grate bars and by walling up the ashpit to support the special burner grates. The fuel is fed directly into the heating plant in large amounts and is burned as needed.

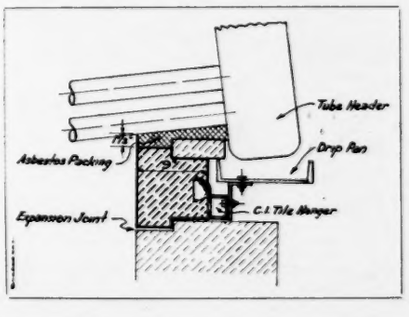
The control system consists of a room thermostat, a high limit control, and an electric clock. When the room thermostat calls for heat, the burner is turned on. It is turned off either when the room reaches the correct temperature or when the heating plant reaches the limiting temperature of the high limit control. Allowing for time for the limit control to cool, if the thermostat setting is still not satisfied, the burner will again operate and continue over this cycle until the desired temperature is reached. The burner then shuts off. This temperature is then maintained by an electric clock that operates the burner on semi-hourly intervals for a predetermined length of time. This setting is governed by the size of the heating plant.

Reintjes Furnace Wall and Arch

Geo. P. Reintjes Co., 2517-19 Jefferson St., Kansas City, Mo., has announced a new development in boiler furnace wall and arch design. The problem of protecting the lower portions of the headers and the ends of tubes in the straight tube type of water tube boiler has been met by using a single belt of supported wall as illustrated.

The tile supporting castings are bolted to the drip pan, which acts as a horizontal frame member. The drip pan can be connected to the boiler columns. Thus this protection is independent of the balance of the wall.

This construction allows the free circulation of air around the drip pan, reducing oxidation, and at the same time prevents the infiltration of excess air into the furnace at this point.



Arco Air Conditioner, Model 101

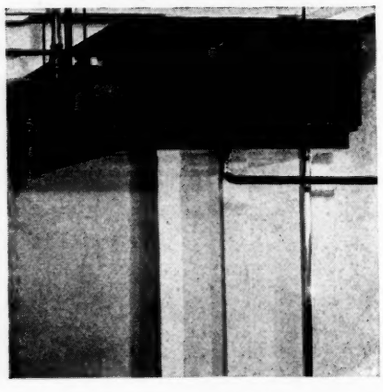
Air conditioning in an integrated system, using radiator heat and installed in accord with the existing technique of the radiator heating contractor, is provided through the Arco air conditioner, model 101. The unit, a product of American Radiator Co., New York, can be hooked in at any point on the supply line of a radiator heating system and will condition a six-room house from that point. It is designed for the $3,000 to $8,000 home. It has been placed on the market for use in connection with the installation of American Radiator heating systems in the west and middle west and its sale will be extended nationally as rapidly as demand and manufacturing facilities permit.

In its simplest form, the conditioner is installed on a basement ceiling with an outlet through the floor above and a register in the floor at a distant point to provide a return of air to the basement. A steam or hot water connection together with water supply, drain, and electrical connections are required.

The blower is powered by a 1/20-hp. motor, both being mounted on a floating cradle that prevents vibration and noise. Viscous type replaceable filters of fiber board are used. A self-cleaning nozzle spray provides humidification and washes the air for winter air conditioning, while provision is made for the installation of refrigerating coils for summer cooling and dehumidification if this is desired.

Through a combination tempering coil and eliminator, cold air is tempered to prevent drafts when outside air is brought in during the winter and entrained moisture is eliminated. An adjustable collar permits air to be discharged at either the side or the top of the unit, and the entire unit is insulated against noise. Use of the conditioner with radiator heat makes controlled distribution of heat possible and permits air to be circulated through a house in winter at all times while heat is varied according to outside weather conditions.

Four different sets of controls provided for the conditioner include manual control with a switch, humidistat control, and also control of the blower to turn it off automatically when the tempering coil is not operating.

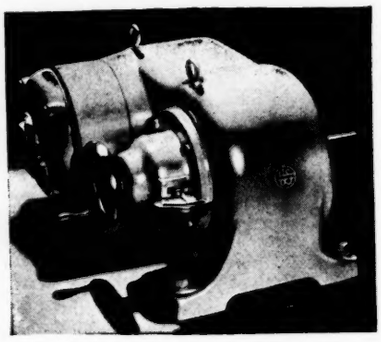


Varidrive Motor

U. S. Electrical Mfg. Co., 80 Thirty-fourth St., Brooklyn, N. Y., and 200 E. Slauson Avenue, Los Angeles, Cal., has announced the U. S. Varidrive motor, a variable speed motor designed especially for ventilating applications. The motor is of the squirrel-cage type built integral with a variable speed transmission, and which can give a speed from 1 to 10,000 r.p.m.

The transmission comprises dual discs coupled with the company's Varibelt. The speed is changed by varying the effective driving diameter of the so-called Varidiscs. The two Varidiscs reciprocally expand and contract for higher or lower speeds, transmitting power through the belt to the takeoff shaft.

To change from one speed to another, the operator turns the hand-wheel. This actuates a traveling hub, which in turn increases or diminishes the distance between the two sides



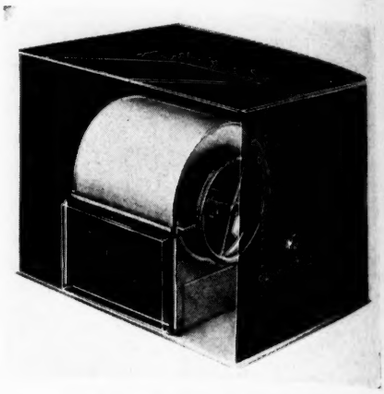
of the driven Varidiscs. A calibrated helical spring automatically and constantly keeps the pulley sections in proper contact with the belt.

Remote control by electric push button or with a hydraulic hand-wheel is available. Various applications of remote control to suit the operator's requirements can be arranged.

Available in a wide range of ratings as low as ¼ hp.

Insulux

Owens-Illinois Glass Co., Muncie, Ind., has placed on the market the Insulux glass block, a structural glass brick which is said to be permanently and hermetically sealed and enclosed in which is a partial vacuum of considerable insulating value. The bricks are translucent, are of value for decorative purposes, and have been designed especially with the idea that they will be applicable where air conditioning is to be installed in a building. They are available in two sizes 4⅞ x 8 x 3⅞ in., and 5¾ x 5¾ x 3⅞ in. The heat transmission of the blocks is 0.292 B.t.u. per sq. ft. per hr.



Climator Fan-Filter Unit

L. J. Mueller Furnace Co., Milwaukee, Wis., has added the Climator V fan and filter unit to its line of filter-blower units. This unit is designed to meet the demand for a popular priced unit. While economies have been effected in the design and construction it is claimed that the unit is of the same basic design as other higher priced units in the line.

It is made in two sizes with either a 1/6- or 1/4-hp. motor and with volume ratings of 1000 to 2400 c.f.m.

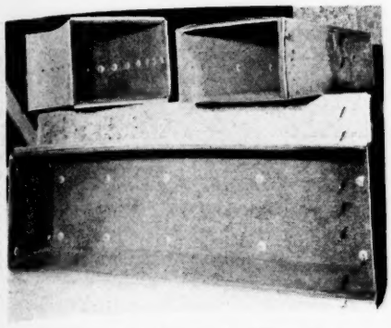
The finish is aluminum bronze but green prismatic lacquer can be furnished at a slight additional cost.

Plastikon

A new type rubber putty, said to be highly resistant to moisture, corrosive chemicals, and fumes, has been developed for sealing windows against air leakage in air conditioned buildings. The putty, a product of The B. F. Goodrich Co., Akron, Ohio, and known as Plastikon, is similar in appearance and consistency to ordinary painters' putty and may be applied with a knife in the same manner. It adheres equally well to steel or wood surfaces and because it contains little oil requires no mixing.

An application of this material was made in the plant of the Onondaga Pottery Co., Syracuse, N. Y. Because the special paper, used in lithographing the many colored transfer designs to go on the pottery, must be kept in the same condition at all times to prevent curling or shrinking, the printing department is housed in a separate brick structure of the steel type, insulated with thick cork, has double glass windows and equipped with a complete air conditioning system which maintains a temperature of 72° the year round.

The double glass windows were sealed with ordinary putty which dried out and broke away. This presented a continuous maintenance problem because the air leaks which developed made it difficult to maintain the constant temperature desired. The substitution of rubber putty has apparently corrected this difficulty.



J. M. Air Acoustic Sheets

Air-Acoustic sheets, designed to reduce or eliminate the noise transmitted through ducts in air conditioning and ventilating systems, have been announced by Johns-Manville, New York.

These sheets are a sound-absorbing material in rigid block form made of rockwool and a suitable binder and are primarily used as duct lining. Because they will not smoulder or support combustion, the maker recommends them for installations where combustible materials would contribute to the fire hazard.

The sheets are said to be highly moisture resistant, to have good sound-absorbing efficiency and low thermal conductivity. They are attached to duct surfaces either by spot cementing with acoustical cement or by mechanical fastenings.

Edison Temperature Control Unit

A temperature control unit for use in dead air spaces where it is necessary to keep the temperature from exceeding any predetermined limit is announced by the Edison Electrical Controls Division of Thomas A. Edison, Inc., West Orange, N. J. This control unit consists of a small glass enclosed thermostat mounted with a suitable guard in the cover of a standard 4 x 5 in. switch box. The thermostat operates a glass enclosed relay, mounted inside the box, which is capable of carrying up to 400 watts. These two elements are wired to a readily accessible terminal board.

All contacts and working parts being hermetically sealed in glass, this control unit is suited for use in out of the way locations where servicing could be accomplished only with difficulty. In both the relay and the thermostat all air is removed and the glass encasing tubes are filled with an inert gas of high thermal conductivity before the final seal is made. This prevents destructive arcing when the contacts open. The thermostat is calibrated to operate at the desired temperature by the manufacturer and subsequently cannot be changed.

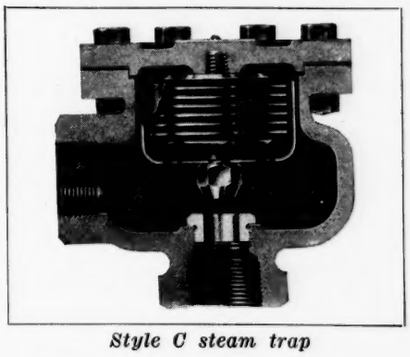
An application is in lofts or attics where excessively high temperatures are encountered during summer months. In such locations the control is used to operate a small exhaust fan.

Nicholson Traps

Two new steam trap models have been introduced by W. H. Nicholson & Co., 208 Oregon St., Wilkes-Barre, Pa.

The style AU trap has a union connection and is of bronze construction. It is adaptable for use on radiators and unit heaters where reduced high pressure steam is used. In event the reducing valve should stick, or get out of adjustment, and the pressure increases up to as high as 150 lb., it is claimed that the pressure will not damage the bellows element. The bellows are made from phosphor bronze tubing hydraulically formed, and with end plates brazed on.

Style C is of cast iron construction and intended for pressures up to 200 lb. It is made in angle type so that the trap drains itself when the steam is turned off. This feature is desirable on outside installations as it prevents freezing. This trap also has the brazed bellows element. Valves and seats are of hardened stainless steel.



Style C steam trap

Four New G-E Fans

Three new commercial air circulating fans designed for use in stores, restaurants, and taverns, and one domestic attic ventilating fan have been announced by General Electric Co. as additions to the G-E fan line. All are pedestal type and three are adjustable for elevation.

Two of the air circulators, one two-speed and the other single-speed, are similar in appearance. Both are equipped with 24-in. blades capable of powerful air delivery. Telescoping steel columns are adjustable in height from 5 ft. 6 in. to 8 ft. 6 in. A hinge joint between the motor and the upper column allows the fan to be tilted 18 degrees above or below the horizontal.

The two-speed model has an air delivery of 3800 cu. ft. at high speed and 2500 cu. ft. at low speed. The single-speed model has a maximum air delivery of 3800 cu. ft. Blades are made of lightweight sheet aluminum which allow maximum speeds to be reached quickly.

These fans are driven by a 1/6-hp., 1140-r.p.m. motor mounted in a resilient base built as an integral part of the motor, which practically eliminates all motor noise. Bearings are wool-packed, with large oil capacity, and drip-proof end shields protect the windings. The single-speed fan uses a resistance type split-phase motor, while the two-speed fan uses a capacitor type motor. Both operate on 110-120 volts, 60 cycles, and draw 250 watts.

The 14-in. air circulator is a single-speed type, similar in construction to the 24-in. fans, with the new G-E broad, curved blades of light weight sheet aluminum. It has an air delivery of 2000 cu. ft. It is powered by a 1/10-hp., 1450 r.p.m. capacitor type motor mounted on the same column and base as the 24-in. fan. It operates on 110-120 volts, 60 cycles, and draws 150 watts.

The attic ventilator is identical with the 14-in. fan, except that its 32-in. pedestal is not adjustable.

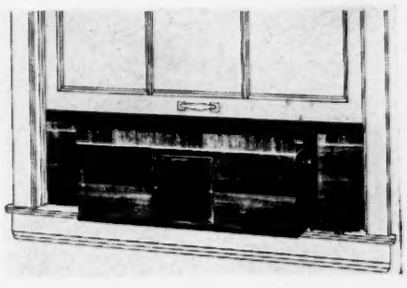
Airrone

Airrone Sales Co., 452 Commercial Sq., Cincinnati, Ohio, a division of Essential Products, Inc., has developed a catalytic compound for the removal of stale and offensive odors in connection with air conditioning equipment. The product is known as Airrone, and two types of diffusing devices have been developed for using it in air ducts with or without conditioning systems.

Airgard Window Filter

The model 40-A Airgard recently announced by the American Air Filter Company, Inc., Louisville, Ky., is fourth in a line of window filters first introduced in 1929. The new model is a self-contained ventilating system including variable speed motor, double blower type fans and an Airmat Dri-filter, enclosed in an attractive cabinet. It is easily installed in any sliding window. It has a positive finger-tip damper control which makes it possible closely to regulate the volume of incoming air to correct the condition without imposing an excess load on the air conditioning unit.

The cabinet is wood, finished in natural walnut or ivory. The air filter, contains 14 sq. ft. of filtering surface. The hinged cover on the unit provides for recirculation of indoor air and the 45° Uniflo outlet grille may be turned to any one of four positions to control the direction of discharge and prevent drafts.



Improved Francke Flexible Coupling

Changes in the design and materials of Francke flexible coupling are announced by the John Waldron Corp., New Brunswick, N. J. All coupling flanges, except the larger sizes, are now made of a forged high manganese alloy steel. The larger sizes are molded of high grade semi-steel.

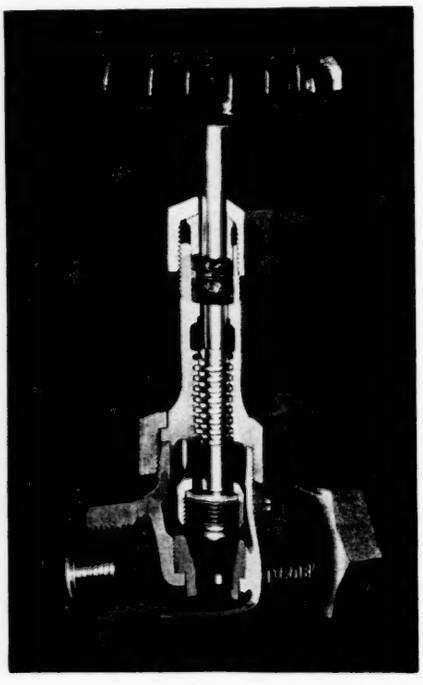
In order to prolong the life of the moving parts of the coupling, self-lubricating, wax impregnated bronze bushings now replace the old style dry bushings. The new bushings have highly polished bearing surfaces which provide a large contact area.

Another improvement is in the design of the cross pins by which the crucible spring steel laminations are held within the keepers. The center portion of the cross pins which passes through the perforation in the laminations is made glass hard. The ends of the cross pins are expanded into the tapered recesses of the keepers so that they cannot become loose.

Hancock Globe Valve

A union bonnet bronze globe valve has been developed by the Hancock Valve Division, Consolidated Ashcroft Hancock Company, Bridgeport, Conn. The new valve has a number of features which, it is claimed, greatly increase its wearing qualities. These include superhard stainless steel valve discs and seat rings, which are said to prevent wire drawing, steam cutting and galling. The disc is attached to the stem in a way that insures correct seating and facilitates regrinding.

The design is said to provide tight back-seating and permits repacking while the valve is in pressure service. Made for steam presures up to 300 lb., the valves are available in both globe and angle patterns.

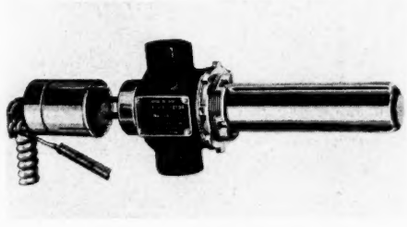


Detroit 545 Boiler Protector

Detroit Lubricator Co., Detroit, has announced the No. 545 boiler protector designed for protection against low water and excessive boiler pressure. It can be used on all steam or vapor systems regardless of the fuel used and regardless of the type of firing.

Whenever the boiler water level drops too low or boiler pressure rises too high for safety, the heat melts a fusible link in the electrode assembly protector. As long as this link remains intact it holds closed the contacts of a safety switch in the main fuel supply circuit. When it melts this circuit is broken and fuel supply is cut off.

The electrode assembly and safety switch are held in a well which is surrounded by an outer housing. The water passages between well and housing are normally filled with boiler water. The housing extends into the flue passages of the boiler where it is



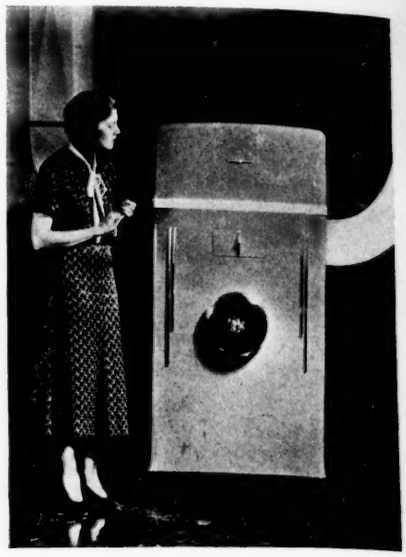
exposed to the heat of the flue gases.

Presence of the water in the housing keeps the well temperature low enough to prevent melting the fusible link. When the boiler water gets low enough to leave the housing, the well temperature rises and the fusible link melts. That stops further fuel supply.

An appreciable length of time is required for the fusible link to reach melting temperature after the boiler water has left the housing. This period is not long enough to jeopardize the boiler, but it is adequate to prevent melting the link during the momentary lowering of the water due to surge. Thus the fuel supply is not subject to a series of short starts and stops.

The temperature of the water in a boiler rises when ever the steam pressure increases. When the boiler pressure reaches 12 lb., the water temperature in the housing passages reaches a point where it can no longer keep the link below its melting point. Thus the boiler can not build up more than 12 lb. pressure.

The protector is installed in the smokepipe breeching except in round cast iron boilers or boilers having a top flue opening. In the latter it is installed in the cleanout door frame.



G.E. Oil Fired Warm Air Furnace

General Electric Co., air conditioning division, Bloomfield, N. J., placed on the market an oil burning warm air conditioner. It is designed for the home of about six rooms.

The unit has a rating of 133,000 B.t.u. per hour, and circulates 1,680 c.f.m. A gallon of water per hour will give humidification in cold weather. A hot water supply heating coil and also a cooling unit will be available.

The furnace is housed in a sheet steel jacket in two-tone gray, with black and chromium trimmings. It stands 5½ ft. high and is 2 ft. 9 in. x 5 ft. 7 in. in plan.

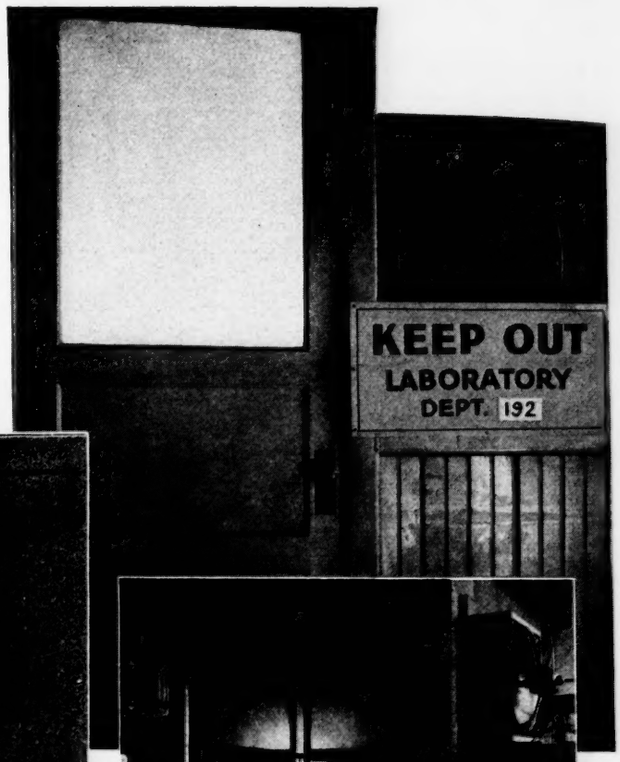
Monobloc Condensate Return Units

Worthington Pump and Machinery Corp., Harrison, N. J., has developed a series of 54 sizes and types of automatic Monobloc condensate return units which are applicable to condensate return services for steam heating systems in hotels, apartment houses, theaters, office buildings and greenhouses, and for steam process plants such as laundries, chemical plants, cleaning and dyeing plants, and in connection with cooking equipment, kilns and dryers. Ratings range from 2,000 to 40,000 sq. ft. of direct radiator or equivalent. Maximum space requirements of the 2000 sq. ft. size being only 21 x 32 x 28 in., and of the 40,000 sq. ft. size, 24 x 57 x 38 in.

Condensate flows by gravity into the storage tank, trips a float switch at a predetermined depth, and the motor is automatically started. When the tank is drawn down to a predetermined minimum level, the motor is automatically stopped. Pump capacities range from 3 to 60 g.p.m.; storage tank capacities from 22 to 98 gal.; and discharge pressures vary from 10 to 40 lb. per sq. in.

Now we're letting YOU in

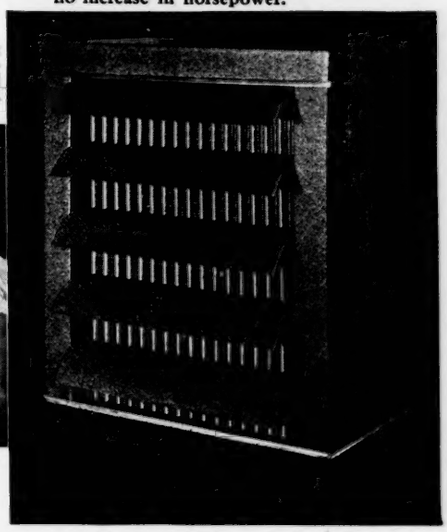
● American Blower's new, improved Venturafin Unit Heaters are ready now! 16 great units... featuring *new beauty of design*—Morocco finish with stainless steel trim ... *Quieter operation*—they're the first and only unit heaters with definite sound ratings ... *New Standards of efficiency*—10 to 64 per cent more heat, 4 to 45 per cent more air (depending on size of unit) with no increase in horsepower. *Stronger, more rugged* and dependable than ever. Built and guaranteed by American Blower ... carried in stock in all principal cities... Mail the coupon for FREE copy of American Blower RED BOOK—tells you how to make real money selling Venturafin—contains plans, pictures, free literature, sales helps, complete catalog.

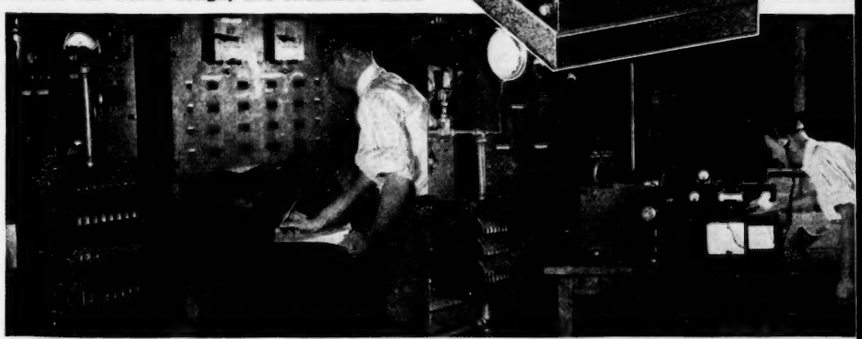


The giant air tunnel used for testing units. The new Venturafin Units deliver 10 to 64% more heat, 4 to 45% more air (depending on size of unit) with no increase in horsepower.

G. C. Polk, Chief Engineer, inspects a new Venturafin Unit Heater, note Morocco finish, new, more efficient fan wheel design, and streamline inlet.

16 great units — each rated for sound.





Sensitive watt meters in the American Blower Research Laboratory record the power input of the new Venturafin Units and prove the new, remarkable economies of operation.

American Blower's extensive sound equipment makes it possible for you to select the proper Venturafin Unit to conform with the existing sound conditions of any job.

American Blower

Sirocco VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT

DIVISION OF AMERICAN RADIATOR and STANDARD SANITARY CORP.

American Blower Corp., 6002 Russell St., Detroit, Mich.
Please send a copy of the American Blower Red Book to:

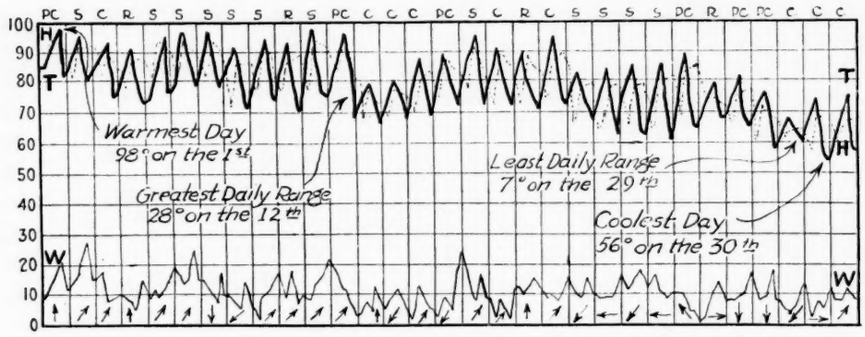
*Name*_____

*Type of Business*_____

*Street*_____ *City and State*_____

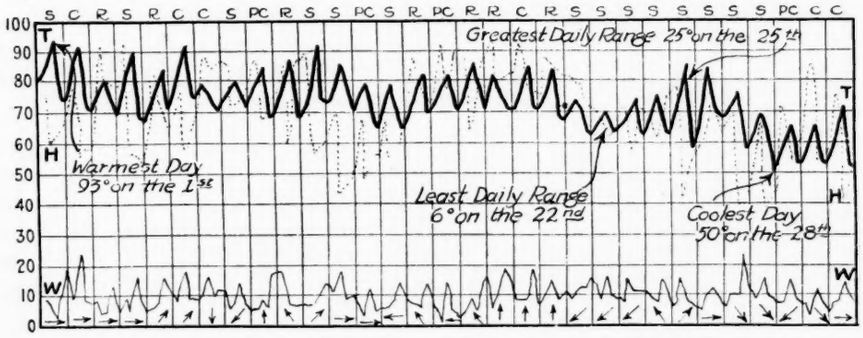
THE WEATHER FOR AUGUST, 1935

Plotted from records compiled for HEATING AND VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity, from readings at 8 a.m., noon, and 8 p.m., except for New York, which shows hourly readings. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions. S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.



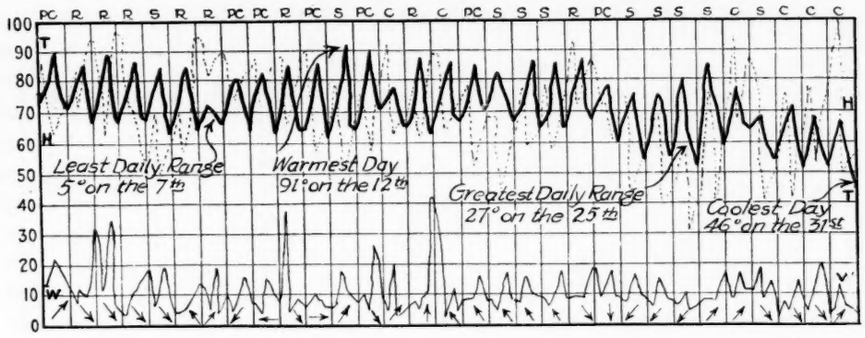
St. Louis

Mean temp. for month, 78.6°; aver. wind velocity, 9.5 m.p.h.; prevailing direction of wind, S.



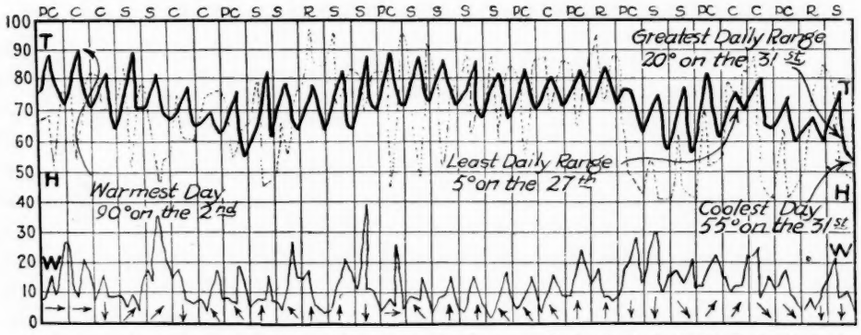
Chicago

Mean temp. for month, 73.4°; aver. wind velocity, 8.5 m.p.h.; prevailing direction of wind, W.



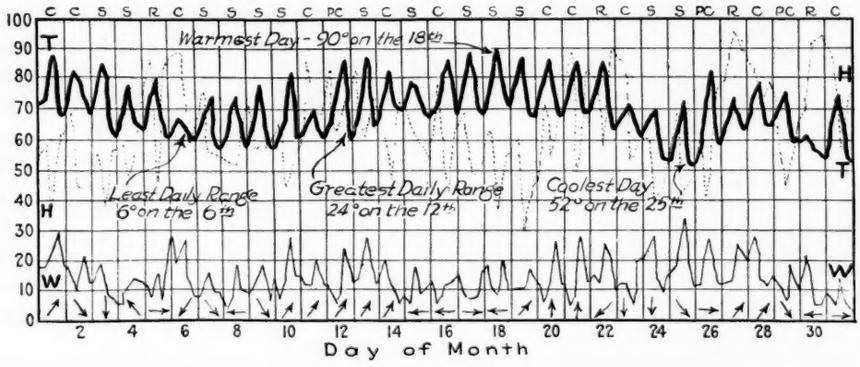
Pittsburgh

Mean temp. for month, 72.1°; aver. wind velocity, 8.7 m.p.h.; prevailing direction of wind, SW.



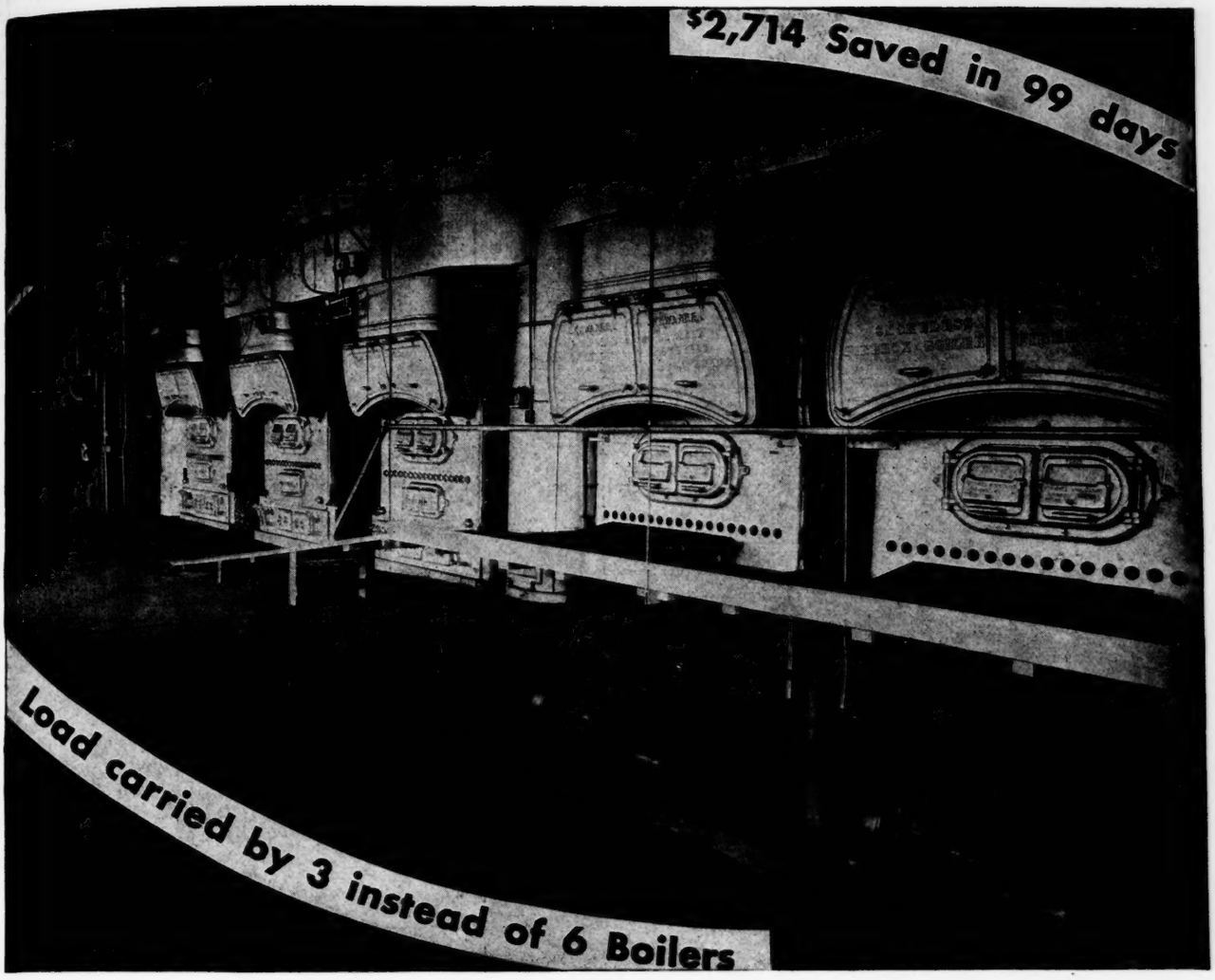
New York

Mean temp. for month, 73.6°; aver. wind velocity, 10.5 m.p.h.; prevailing direction of wind, N.


Warmest Day - 90° on the 18th
Least Daily Range
6° on the 6th
Greatest Daily Range
24° on the 12th
Coolest Day
52° on the 25th
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Boston

Mean temp. for month, 70.7°; aver. wind velocity, 12.2 m.p.h.; prevailing direction of wind, SW.



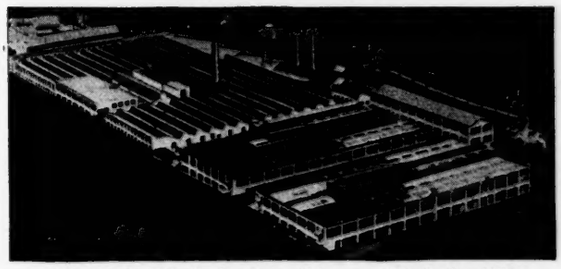
When Waukesha MOTOR installed Detroit UniStokers

REG. U. S. PAT. OFF.

In 1932, the Waukesha Motor Company, Waukesha, Wisconsin, installed Detroit UniStokers under three of its six boilers. During the first 99 days (Dec. 22, 1932 to Apr. 1, 1933) of operation with the Detroit Stokers, the total coal and labor cost was $6020.10, while during the same period of the previous year the cost was $8734.15. Average temperatures for the two periods were practically the same.

The Detroit Stokers not only effected a saving of 31%, but they also increased the capacity of the boilers to the point where the entire load is now carried by the three stoker-fired boilers.

This is typical of Detroit Stoker performance in many plants. Detroit Stokers quickly pay for themselves out of savings; they respond to changes in load and uniform steam pressure is maintained. Write for a copy of Bulletin 673



Plant of the Waukesha Motor Company, Waukesha, Wis.

DETROIT STOKER COMPANY

Sales Offices and Engineering Department:
Third Floor, General Motors Building, Detroit, Mich.
Works at Monroe, Mich.—District Offices in Principal Cities
BUILT IN CANADA AT LONDON, ONTARIO

MODERNIZE AND ECONOMIZE WITH

DETROIT STOKERS

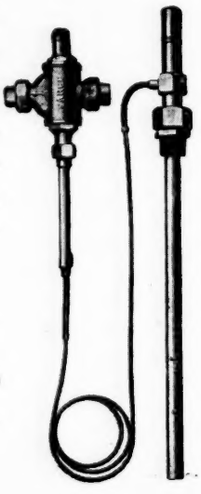
If anything goes wrong with the apparatus on a ship while at sea, it is impossible to ring up the manufacturer and get it fixed in a few hours. Consequently, it is important to install only equipment that has proved dependable.

It is a convincing tribute to the satisfactory performance and long life of Sarco Temperature Regulators to be selected for the Normandie—the greatest mass of steel and machinery ever to sail the sea.

Sarco Temperature Regulators are dependable because they are simple in construction and have nothing to get out of order. They have no troublesome stuffing boxes. The valve body cannot be distorted when installing. Valve seats will not stick and are easy to regrind when worn.

Sarco Regulators are a complete power plant in themselves. No compressed air, electricity or water pressure is needed for their operation.

Simply set a Sarco for any desired temperature and it automatically maintains that temperature without attention.



Made in various types for maintaining temperatures in cold storage rooms, hot water heaters, cookers, retorts, pasteurizers, drying rooms, kilns, etc.

Write for Catalog P-52.

SARCO CO., INC.
183 Madison Ave., New York, N.Y.
Branches in Principal Cities
Sarco Canada Limited, Federal Bldg., Toronto, Ont., Canada

NEW CATALOGS

Unless otherwise indicated, the publishers of catalogs will supply copies on request without charge.

Air Reduction Sales Co., Lincoln Bldg., New York. A standard size 24-page heavy paper bound booklet entitled "The Facts About Welded Piping for Buildings." Planned especially to interest heating engineers and building and plant executives the booklet is designed to show the advantages of using the Aircowelding process for welding pipe. The booklet is profusely illustrated with photographs of typical installations and some specific information is given regarding each. Pipe welding specifications for heating and refrigeration installations with numerous drawings are also presented.

Automatic Temperature Control Co., Philadelphia. A 16-page manual, catalog TC, in which the controlling of time in connection with industrial operations and processes is given comprehensive yet condensed treatment. Readers are guided in their approach to the subject by analysis of specific jobs to be performed. Choice of equipment from various types of instruments available is thereby simplified.

Bailey Meter Co., 1050 Ivanhoe Road, Cleveland. A 32-page bulletin entitled Air-Operated Combustion Control and designated as No. 102. Describes a complete combustion control system which automatically maintains steam pressure, combustion efficiency and furnace draft. It explains in detail how the system ties in with the company's boiler meter automatically to readjust fuel-air ratio.

S. R. Dresser Mfg. Co., Bradford, Pa. A booklet on pipe joints, Form 355, intended for those who have to do with the construction, operation, or maintenance of pipe lines. Contains 16 pages, includes a number of installation pictures, as well as general information on various pipe line products.

The Edwards Manufacturing Co., Inc., 5th and Butler Sts., Cincinnati, Ohio. A four-page folder describing, illustrating, and presenting engineering data on the company's Hot-Kold heating and winter air conditioning unit.

The Emerson Electric Mfg. Co., Inc., St. Louis, Mo. Catalog X573, a standard size, eight-page bulletin describing the company's line of furnace blowers, washers, filter housings, furnace fans, and bonnet controls.

The Gates Rubber Co., Denver, Colo. Installation and operation of V-belt drives is discussed in a simplified 48-page book on V-belt engineering just published by this company. Any drive can be completely designed, and the delivered price determined, from this one text. A section on the care of V-belt drives outlines an easy way of checking tensions, and discusses the effect on V-belts of oil, water, steam, dust, and chemical fumes. Other sections in the book include instructions for the design of V-drives, quarter-turn drives, double-V drives, and V-flat drives.

Hancock Valve Division, Consolidated Ashcroft Hancock Co., Inc., Bridgeport, Conn., has published a four-page bulletin in color illustrating and describing the company's new Hancock Flocontrol valve. This valve is a standard type globe or angle valve having a micrometer type dial and pointer which enables the operator to read the valve opening in fractions of turns of the handwheel. It is fitted with a four V-port disc which produces proportional flow throughout the full lift of the valve stem. It is available in seven sizes ranging from ⅜ in. to 2 in. The company has also published a bulletin on its union bonnet bronze valve, standard size, eight pages.

Johnson Fan and Blower Corp., 1319-25 West Lake St., Chicago. Bulletin 3560, a 24-page publication containing detailed capacity tables, dimensional data, and descriptive information on the company's line of propeller type unit heaters.

(Concluded on page 74)

"No Wonder Contractors like Speed Heaters!"

. . . THEY SAVE TIME · TEMPER · TROUBLE

1. SPEEDY, EASY INSTALLATION . . . this is a Sturtevant Speed Heater feature that has a big appeal for contractors. They know that threaded connections for steam supply and return lines are provided on both sides of the heater. They simply connect to the side nearest the supply line.

Handy strap hangers are furnished with each Speed Heater. Easily formed in a vise to fit any condition.

2. ABSOLUTELY LEAK-PROOF—Speed Heaters are equipped with special Sturtevant-made heating elements of the extended-surface copper-fin type . . . absolutely leak-proof. Header joints are made permanently tight by an exclusive Sturtevant method.

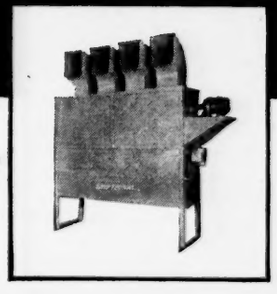
3. GUARANTEED FOR 200 LBS.—Every Speed Heater is guaranteed to withstand steam pressures up to 200 lbs. per square inch. Actually operating successfully on much higher pressures. Work equally well on high and low pressures.

4. MAXIMUM HEADROOM—As both supply and return connections are made on sides of the Sturtevant Speed Heater, maximum head clearance is provided. A big advantage where headroom is limited.

5. QUICK SHIPMENT—Fast, on-the-dot service when Speed Heaters are ordered. The most popular voltages are stocked in many locations. Other standard voltages at Hyde Park, Boston, Mass.

SPEED HEATERS ARE DISTRIBUTED BY CRANE CO.

B. F. Sturtevant Co., Hyde Park, Boston, Mass.
New York, 420 Lexington Ave. Chicago, 400 N. Michigan Ave.
San Francisco, 681 Market St. *Branches in Other Cities*



Rexvane Speed Heaters ➤

For floor, wall or ceiling installation. Built in a wide variety of types and sizes ranging from 100,000 to 1,000,000 B.T.U.

Sturtevant Speed Heaters

SEND FOR COMPLETE DATA

B. F. Sturtevant Company, Hyde Park, Boston, Mass. H.V. 10-35

- ☐ Send me Suspended Type Speed Heater Catalog No. 396.
- ☐ Send me Rexvane Speed Heater Catalog No. 395.
- ☐ Have your representative call.

Name----------

Company----------

Address----------

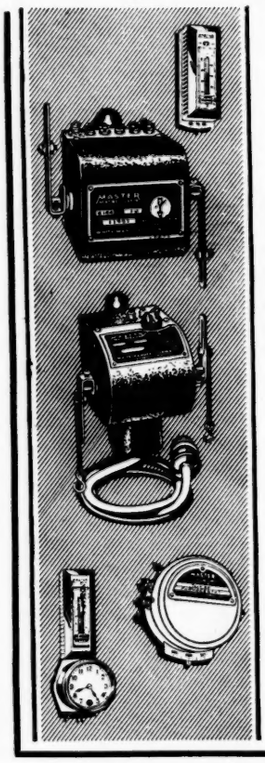
Like an arrow

from the bow of

William Tell

EVERY MASTER HEAT REGULATOR COMES FROM A RECOGNIZED MASTER IN ACCURACY

Just as anyone can shoot arrows, so anyone can make heat regulators. But White Manufacturing Company has been making heat regulators for a great many years. And the difference is worth getting.



NEW IMPROVED

B-144

4-Position

The Original Gradual Control Heat Regulator

Has such features as the Master Thermo-Wafer in place of the common thermostatic bellows, small non-inductive load, platinum-irridium points, split-second action and attractive thermostat.

Type B-22

2-Position

Made for your biggest market—the moderate salaried home owner. Noiseless, accurate, will outlast the heating plant, listed as standard and easy to install. And imagine—

A Master Heat Regulator for only **$13.50**

Write for complete information concerning this Full Line of reliable heat regulators.

MASTER HEAT REGULATOR

WHITE MANUFACTURING CO.
2364 University Avenue, ST. PAUL, MINN.

(Concluded from page 72)

Lawrence Pump and Engine Co., P. O. Box 70, Lawrence, Mass. An attractive six-page standard size booklet in which Vortex Black Arrow single stage centrifugal pumps are announced. These pumps are built in sizes from 2 to 14 in., inclusive, for capacities from 30 to 10,000 g.p.m. and for heads up to 300 ft. They are of the double suction, horizontal split casing type, especially adapted for general pumping service, and are suitable for industrial plants, power houses, public buildings and hospitals.

The Patterson-Kelley Co., Inc., East Stroudsburg, Pa. A four-page, standard size catalog, Section No. 701, describing and illustrating the company's solid Everdur hot water service and storage heater.

B. F. Sturtevant Co., Hyde Park, Boston, Mass. Catalog 396-2, a standard size, 20-page catalog with illustrations, drawings, capacity and dimensional data and information relating to the company's line of speed heaters. Also catalog 377-1, a standard-size, 20-page bulletin devoted to the company's unit ventilators.

The Trane Co., La Crosse, Wis. Bulletin 105 *entitled* "Trane Orifice System" outlining and illustrating the advantages of the company's orifice system of steam heating. Standard size, 8 pages in color.

Warren Webster & Co., Camden, N. J. Bulletin B-727B entitled Boiler Protection. A standard size, eight-page bulletin in color describing the company's boiler protector. Gives facts regarding boiler breakage and its protection, the design of the boiler protector and its capacity, together with numerous illustrations.

Waverly Heating Supply Co., 32-38 Union St., Boston, Mass. Manual of warm air heating and catalog of appliances featuring forced air and air conditioning systems. A standard size, 130-page catalog of complete supplies for warm air furnace dealers. Included is information on surveying, designing of warm air furnaces, instructions for running ducts and for changing gravity systems to forced air together with a large number of tables and other engineering information necessary for estimating and designing such plants, including data on air conditioning. Available on request in the New England territory.

The Will-Burt Co., Orrville, Ohio, Bulletin W-104, an eight-page catalog in color describing the company's 40-50 domestic stoker.

H. A. Wilson Co., Newark, N. J. Comprehensive review of specifications, properties, and methods of application of modern thermostatic bi-metals, entitled Blue Book of Thermometals. Ten full-page charts showing deflection and force characteristics, along with appropriate design formulas, provide up to the minute engineering data for bi-metal applications throughout the field of temperature indication and thermal control. A section devoted to derivation of thermometal formulas is valuable to those whose design problems require a more fundamental analysis than the standard formulas provide. Methods of heat treatment recommended to relieve stresses set up in working or forming thermometal elements are outlined in detail. Thirty-two pages, bound in loose-leaf form.

Yarnall-Waring Co., Chestnut Hill, Philadelphia. Bulletin T-1720, covering the company's Yarway impulse steam trap. Profusely illustrated.

ABSTRACTS

(Continued from page 59)

The Building Industry and Business Cycles

The depression has resulted in a renewed awareness of the need for critical analysis of past business fluctuations, and numerous studies are being carried on to satisfy this need. William H. Newman has made a study of the building industry and business cycles in a doctoral dissertation for the School of Business of the University of Chicago. Discussed in the book are the factors which influence build-

ing activity, the relation of building activity to building cycles, and the effect on building of cost of building, financing, real estate, prices, population, growth, incomes, vacancies and operating costs.

[*"The Building Industry and Business Cycles," by William H. Newman. A 6 x 9 in., heavy paper bound booklet, 73 pages, including tables on building activity indexes, costs, and similar data. Published by the School of Business of the University of Chicago. Price $1.*]

BRIEF REVIEWS

WHOLESALE OUTLETS—A market study of wholesale outlets conducted for "Advertising Age" and made by the Ross Federal Research Corporation. It covers information on business conditions and trends of wholesalers in six large cities, including plumbing and heating wholesalers. [*"A Market Study of Wholesale Outlets." Standard sizes, mimeographed form, 47 pages. Obtainable from "Advertising Age," 100 East Ohio St., Chicago.*]

CHECK SHEET—INTRODUCTION OF NEW INDUSTRIAL PRODUCTS. One of the Market Research Series, No. 6, of the Department of Commerce, and designed to acquaint the industrial executive with information needed when new products are being introduced. [*"Check Sheet—Introduction of New Industrial Products." In mimeographed form, bound with heavy paper, 23 pages with foldover check sheet. Price 5 cents, available from the Department.*]

REQUIREMENTS FOR SWIMMING POOLS. A set of rules and regulations recently adopted by the State of Illinois regarding the minimum sanitary requirements for swimming pools and bathing places. [*"Minimum Sanitary Requirements for Swimming Pools and Bathing Places" adopted by the Department of Health, State of Illinois. Mimeographed Sheets; 8½ in. x 11 in.; 7 pages.*]

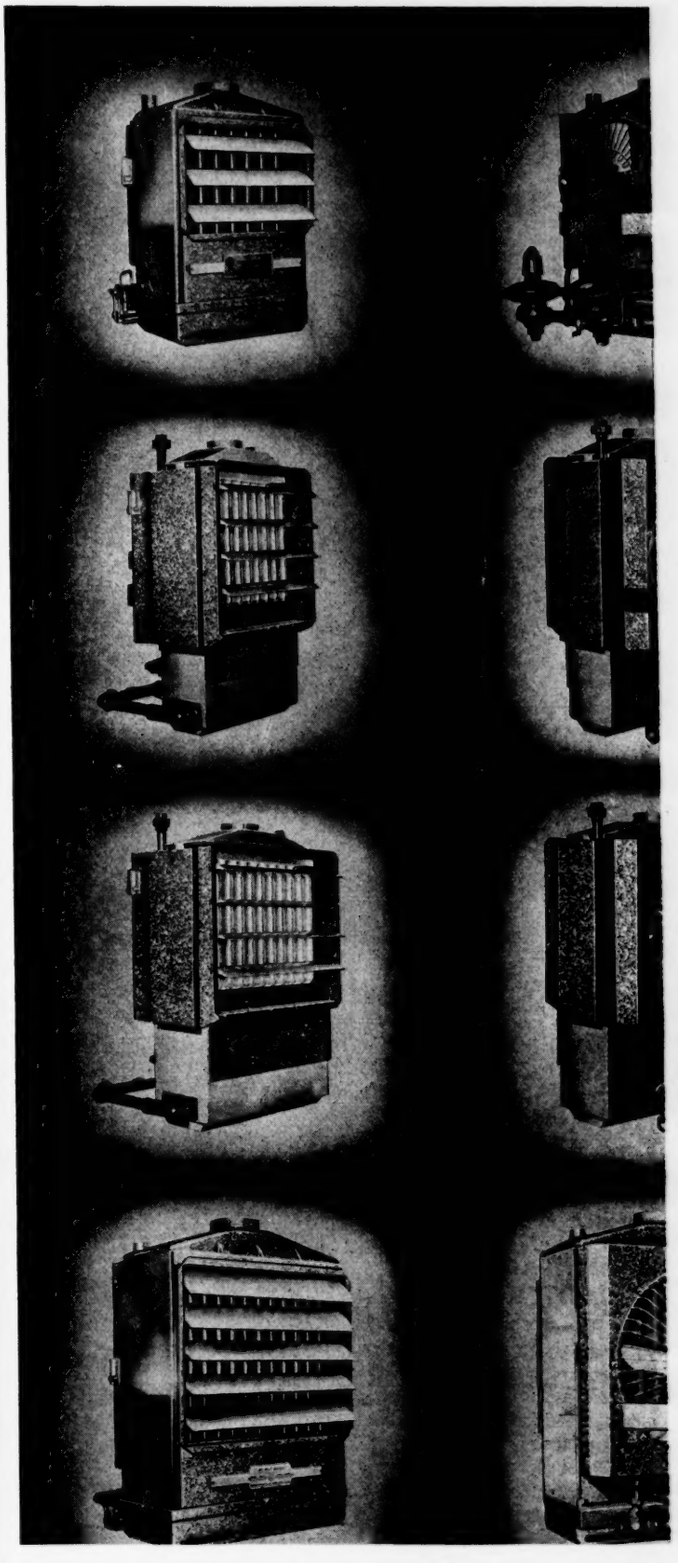
Heating Business Up 60%, Building Up 50%

(Concluded from page 31)

NUMBER AND COST OF NEW BUILDINGS AND OF ALTERATIONS FOR WHICH PERMITS WERE ISSUED IN 94 IDENTICAL CITIES. DATA FROM UNITED STATES BUREAU OF LABOR STATISTICS.

Kind of building	Buildings for which permits were issued				Percentage change	
	First half of 1935		First half of 1934			
	Number	Cost	Number	Cost	Number	Cost
Residential buildings:						
1-family dwellings	10,806	$44,031,903	4,722	$19,062,838	+128.8	+131.0
2-family dwellings	517	2,934,522	307	2,034,610	+68.4	+44.2
1-family and 2-family dwellings with stores	54	417,421	45	241,395	+20.0	+72.9
Multifamily dwellings	472	27,521,873	97	8,865,470	+386.6	+210.4
Multifamily dwellings with stores	22	2,788,450	6	93,000	+266.7	+199.8
Hotels	2	92,664	1	125,000	+100.0	−25.9
Lodging houses	3	8,200	0	0		
All other	11	785,900	6	362,975	+83.3	+116.5
Total, residential buildings	11,887	78,580,933	5,184	30,785,288	+129.3	+155.3
Nonresidential buildings:						
Amusement buildings	138	3,885,297	158	1,490,862	−12.7	+160.6
Churches	185	1,828,942	84	1,102,150	+25.0	+70.5
Factories and workshops	366	9,097,420	291	4,776,771	+25.8	+90.5
Public garages	124	1,043,954	115	1,030,335	+7.8	+1.3
Private garages	11,916	2,906,060	8,593	2,340,950	+38.7	+28.0
Service stations	946	2,751,627	765	2,386,685	+23.7	+15.3
Institutions	19	4,315,635	25	2,618,189	−24.0	+64.8
Office buildings	56	1,308,225	42	10,436,139	+33.3	−87.5
Public buildings	126	22,845,646	82	13,355,505	+53.7	+71.1
Public works and utilities	86	13,847,260	73	4,114,790	+17.8	+236.5
Schools and libraries	148	14,009,629	70	10,190,065	+111.4	+37.5
Sheds	2,991	959,579	2,983	873,375	+.3	+9.9
Stables and barns	86	57,028	184	192,687	−53.3	−70.4
Stores and warehouses	1,839	11,796,562	1,506	9,978,558	+22.1	+18.2
All other	290	1,224,006	357	634,835	−18.8	+92.8
Total, nonresidential buildings	19,236	92,016,870	15,328	68,521,896	+25.5	+34.3
Total, new buildings	31,123	170,597,803	20,512	99,307,184	+51.7	+71.8
Additions, alterations, and repairs	88,105	68,574,515	70,905	52,514,337	+24.3	+30.6
Grand total	119,228	239,172,318	91,417	151,821,521	+30.4	+57.5

washers during July fell off to a low level. Nearly 3,000 residential stokers were sold during July, as compared with only 856 in July of 1934. A sharp increase is noted in the sale of cast iron convectors which reached 271,000 sq. ft. in July as compared with only half that much in July of 1934.



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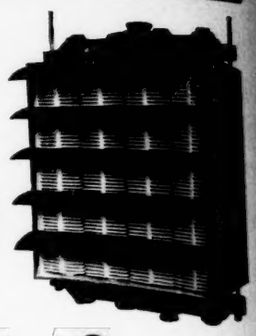

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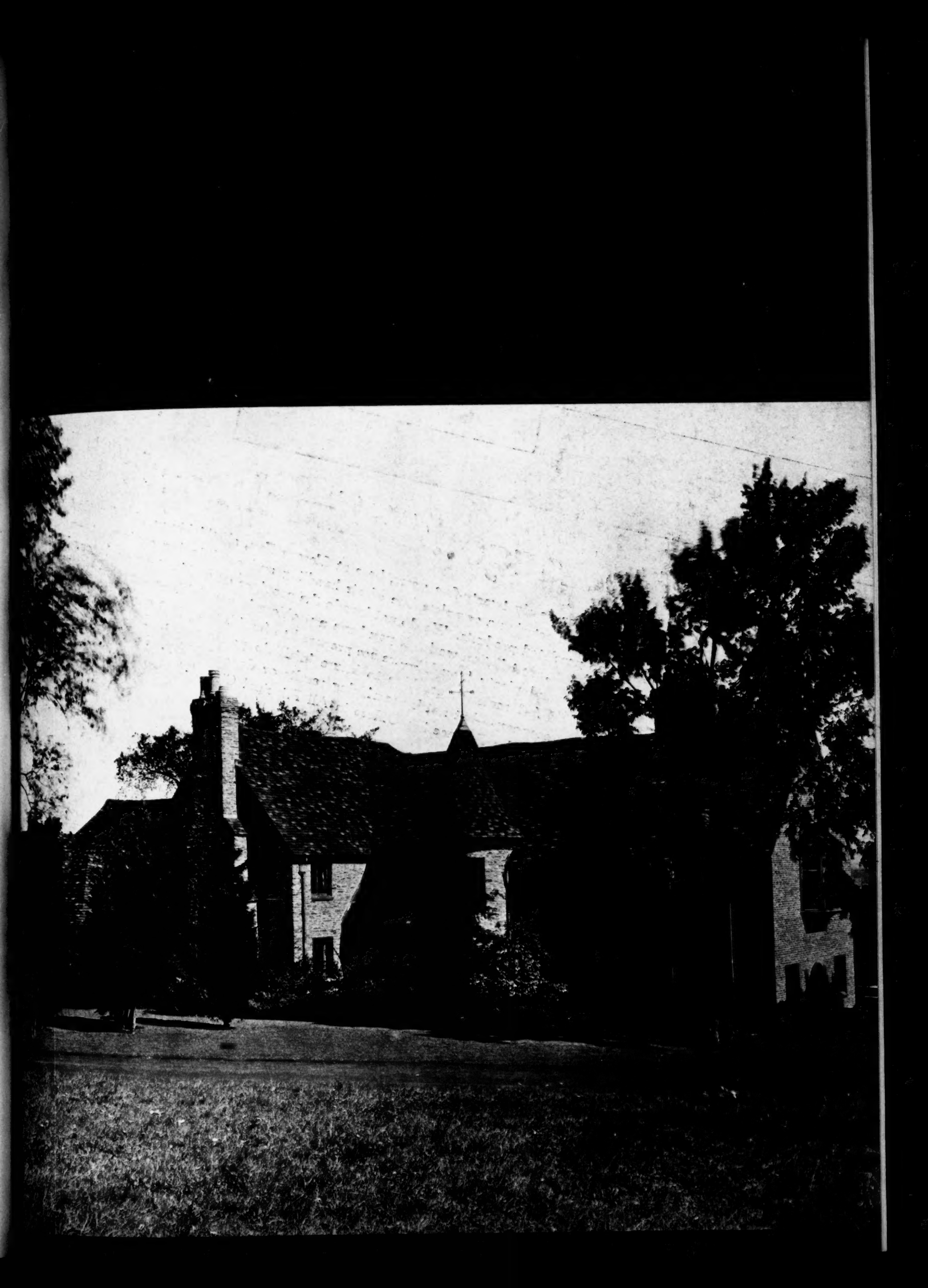
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